

1990 Update

Fish Tissue Dioxin Levels in North Carolina

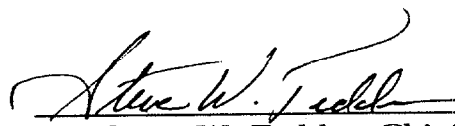
**North Carolina Division of Environmental Management
Water Quality Section**

1990 Update
Fish Tissue Dioxin Levels in North Carolina

North Carolina Department of Environment,
Health, and Natural Resources

Division of Environmental Management
Water Quality Section

This report has been approved for release


Steve W. Tedder, Chief

Date March 14th, 1991

TABLE OF CONTENTS

	<u>Page</u>
Introduction.....	1
Background.....	1
Historical Studies and the 1990 Approach.....	2
Evaluation Criteria.....	4
Dioxin in Whole Fish Samples.....	4
Quality Assurance.....	5
Coastal North Carolina Fish Fillet Dioxin Results.....	7
The Cape Fear System.....	9
The Neuse River System.....	11
Roanoke River System.....	14
Chowan River System.....	16
Albemarle Sound System.....	18
Pamlico River System.....	19
Crab and Oyster Results.....	19
French Broad River System.....	20
Pigeon River System.....	22
Lumber River System.....	24
Summary.....	26

Appendix A. Summary of Individual Dioxin Fish Tissue Samples.

Appendix B. Station Location Summary for Dioxin Samples Comparing 1990
Collections with Previous Years.

Appendix C. Current Fish Consumption Health Advisories for Dioxin in
North Carolina

LIST OF FIGURES

	<u>Page</u>
1. Pulp and Paper Facilities in North Carolina.....	2
2. Coastal Dioxin Monitoring Stations.....	8
3. Cape Fear River System.....	10
4. Neuse River System.....	13
5. Roanoke River System.....	15
6. French Broad River System.....	21
7. Pigeon River System.....	23
8. Lumber River System.....	25

LIST OF TABLES

1. Paired Observations for Duplicate Sample Analysis From 1990	5
2. Results of Split Samples between Weyerhaeuser and Triangle Labs.....	6
3. Dioxin Sampling Locations in Coastal North Carolina	7
4. Cape Fear River System Dioxin Fish Fillet Summary For 1990	9
5. Cape Fear River System Dioxin Fish Fillet Summary For 1984-1990.....	9
6. Neuse River System Dioxin Fish Fillet Summary for 1990	11
7. Neuse River System Dioxin Fish Fillet Prior to 1990.....	12
8. Roanoke River System Dioxin Fish Fillet Summary For 1990.....	14
9. Roanoke River System Dioxin Fish Fillet Summary 1987 through 1989...16	16
10. Chowan River System Dioxin Fish Fillet Summary 1990.....	17
11. Chowan River System Dioxin Fish Fillet Summary 1988 through 1989...17	17
12. Albemarle Sound Fish Fillet Summary for 1989.....	18
13. Albemarle Sound Fish Fillet Summary for 1990.....	18
14. Pamlico River Fish Fillet Samples from 1990	19
15. Dioxin Analyses of Blue Crabs in North Carolina	19
16. French Broad River System Dioxin Fish Fillet Summary for 1990	20
17. French Broad River System Dioxin Fish Fillet Summary for 1989	20
18. Pigeon River System Dioxin Fish Fillet Summary For 1987-1988	22
19. Lumber River System Dioxin Fish Fillet Summary for 1990.....	24
20. Lumber River System Dioxin Fish Fillet Summary for 1989.....	24
21. Sampling Locations with Average TEQ's Greater than 3 ppt.....	26
22. Sampling Locations with Individual Observations Greater than 3 ppt, but station average TEQ's less than 3 ppt	26

1990 Update

Fish Tissue Dioxin Levels in North Carolina

Introduction

Dioxin has accumulated in fish found in the receiving waters of pulp and paper facility effluents. Elevated levels of dioxin found in fish during 1989 sampling prompted the State Health Director to issue several fish consumption advisories (listed in Appendix C). This report summarizes the analytical results of dioxin measured in fish tissue with emphasis on results from 1990 collections. All available data, whether collected by the Environmental Protection Agency (EPA), the Division of Environmental Management (DEM), or the pulp and paper industry, are included in Appendix A. The new information presented within this summary report will be evaluated by the Division of Epidemiology and the State Health Director. This evaluation will determine if dioxin fish consumption advisories for the recreational and commercial harvest of fish require modification. The Division of Marine Fisheries and the Wildlife Resources Commission will likely receive recommendations from the State Health Director based on this risk assessment evaluation. The Wildlife Resources Commission and the Division of Marine Fisheries are responsible for regulatory and fisheries management decisions on consumption advisories.

Background information on dioxin contamination and the facilities required to test fish tissue are included. Also included is a brief summary of past work and the rationale for testing in 1990. Site selection, species tested, and analytical methods were chosen after careful consideration of data needs and lengthy discussions with the Division of Epidemiology, Division of Marine Fisheries, and the Wildlife Resources Commission. The 1990 spatial extent of sampling varied tremendously due to the location of pulp and paper facilities and the nature of the receiving waters.

Background

Polychlorinated dibenzofurans (PCDF's) and polychlorinated dibenzo-p-dioxins (PCDD's) are two groups of compounds composed of 135 and 75 individual isomers respectively. Some of these isomers are toxic at extremely low levels, particularly those with chlorine substitutes in the 2,3,7,8 positions. This collective group of 210 individual isomers is commonly referred to as dioxin. The formation of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and 2,3,7,8-tetrachlorodibenzofuran (TCDF) in the bleaching of certain pulp material and the discharge of TCDD and TCDF from pulp and paper mills has been well documented.

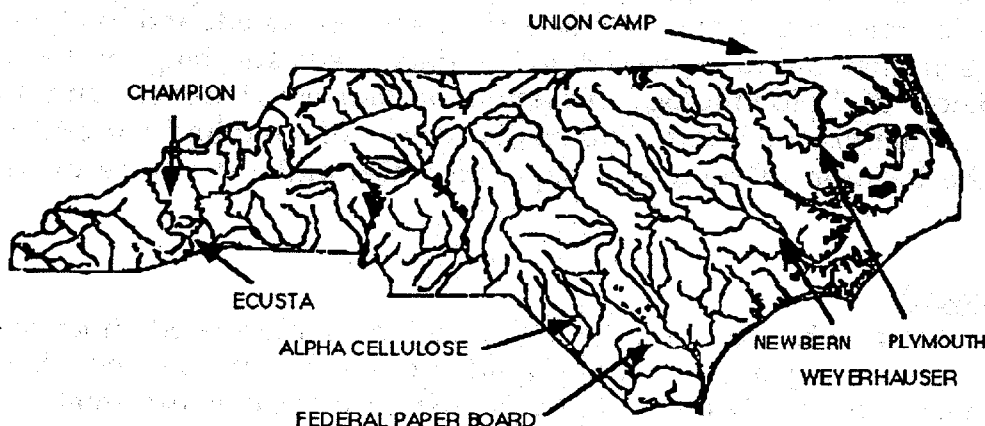
The Environmental Protection Agency (EPA) initiated nationwide studies to determine if fish tissue had been contaminated by dioxins and furans. Results of these studies in North Carolina revealed dioxin fish contamination near pulp and paper facilities that used a bleaching process. Under the authority of Section 308 of the Clean Water Act, administration of surface water discharge permits (NPDES) and North Carolina General Statutes §143-215.3, the Division of Environmental Management required pulp and paper facilities to assess dioxin contamination in fish and/or shellfish tissue in effluent receiving streams.

The following is a list of pulp and paper facilities discharging to North Carolina surface waters (Locations shown in Figure 1) :

<u>Facility</u>	<u>Location</u>	<u>Receiving System</u>
Champion Paper	Canton	Pigeon River
Weyerhaeuser	Plymouth	Roanoke River
Weyerhaeuser	New Bern	Neuse River
Ecusta, P.H. Glatfelter	Asheville	French Broad River
Alpha Cellulose	Lumberton	Lumber River
Federal Paperboard	Riegelwood	Cape Fear River
Union Camp	Virginia	Chowan River

Given concern by the public, industry, and government agencies, this summary is intended to provide new individual fish tissue monitoring data from the above facilities and from agency monitoring activities. It is further intended to composite all fish tissue information on dioxin into one summary document available to all interested parties. Summarized results of all dioxin fish tissue monitoring in North Carolina performed by industry, DEM and EPA are included in Appendix A. Laboratory support for these results was made available by EPA, the Albemarle Pamlico Estuarine Study (APES), and by individual pulp and paper industries.

Figure 1. Pulp and Paper Facilities in North Carolina



Historical Studies and the 1990 Approach

Dioxin in fish tissue was first sampled by DEM in 1984 as part of the National Dioxin Study. Sample locations were selected as background sites to determine if 2,3,7,8-TCDD was ubiquitous in the aquatic environment. In the spring of 1987, under the National Bioaccumulation Study, additional isomers were evaluated. Site selection included three contaminated sites and one background site. All four sites had detectable levels of dioxin. These results revealed concerns for fish tissue contamination below pulp and paper facilities using a bleaching process in North Carolina. To further investigate this issue, fish tissue samples were collected below five pulp and paper mills during the winter of 1987/88 and below two other mills during the summer of 1988. Detectable levels of dioxin were found at all seven locations. Additional sampling occurred in 1989 as part of the Albemarle Pamlico Estuarine Study (APES). These sites also had detectable levels of dioxin.

As a result of this information and the needs of the Division of Epidemiology to evaluate public health concerns, bleached pulp and paper industries were required to perform assessments of fish tissue in effluent receiving streams in 1990. Concurrent with this effort by industry, the Division of Environmental Management, assisted by the Division of Marine Fisheries and the Wildlife Resources Commission, conducted additional evaluations to determine the spatial extent of dioxin contamination in fish tissue.

Based on the information obtained from 1984 through 1989, the Division of Environmental Management elected to focus 1990 fish tissue monitoring efforts on 2,3,7,8-TCDD and 2,3,7,8-TCDF. This decision was based on the composition of dioxin isomers encountered in previous sampling and the toxicity equivalency factor (TEQ) rating of these isomers. The TEQ value is calculated assuming additivity of effects from individual congeners of dioxins and furans and is expressed as an "equivalent amount of 2,3,7,8-TCDD." The basis for this approach is to aid in the assessment of the human health risks posed by mixtures of dioxins and furans since the bulk of toxicological research has been performed on the TCDD congener. Thus, by combining the TEQ approach with the toxicology information available on TCDD, the risks associated with consumption of a mixture of dioxins and furans in fish tissue can be estimated. Dioxin congener information obtained from 1984 through 1989 indicated, that on the average, TCDD and TCDF laboratory analysis provided greater than 90% of the dioxin information necessary to calculate the total toxicity equivalency value (TEQ)¹. The 90% return of information and cost efficiency in analyses suggested benefits in performing 2,3,7,8-TCDD and 2,3,7,8-TCDF analysis only. Laboratory identification of additional isomers is quite expensive and provides little additional information. Therefore, the new information available within this summary reflects the most cost effective and timely acquisition of dioxin data from all available sources by focusing measurements on 2,3,7,8-TCDD and 2,3,7,8-TCDF. Furthermore, composite samples were analyzed, thus maximizing the efficiency of laboratory costs and providing information from a large number of fish.

¹North Carolina Division of Environmental Management, Water Quality Section. (1990) Fish Tissue Dioxin Levels in North Carolina.

Evaluation Criteria

Recognizing the public and toxicological concerns resulting from exposure to dioxin, the EPA developed and recommended an interim method to assist in estimating the risk from exposure to dioxin mixtures. This interim method generates "2,3,7,8-TCDD equivalence factors" (TEF's also known as TEQ's) of complex mixtures of isomer specific data. TEQ's are relative values and are a means of relating toxicity data for a specific dioxin congener to an equivalent level of 2,3,7,8-TCDD. The TEQ's generated from available toxicity data can be used, assuming additivity of the toxic responses, for estimating the relative toxicity of a mixture of known congeners. When isomer specific concentrations are analytically determined, TEQ's of 2,3,7,8 TCDD equal the sum of all factored observations (toxicity equivalency factor of each congener multiplied times the concentration of each congener). While some extended isomer identifications are available for North Carolina samples, most recent TEQ data has been calculated based on the presence of 2,3,7,8-TCDD and 2,3,7,8-TCDF only. Note that TEQ values based on 2,3,7,8-TCDD and 2,3,7,8-TCDF only are indicated by an asterisk next to the individual sample results in Appendix A. Occasionally the notation "EMPC" will be found in the text. This notation indicates that the exact concentration of the sample could not be determined but an estimate of the maximum potential concentration was obtained. For purposes of averaging sample results, the EMPC value was assumed to be a sample result.

EPA first adopted the TEQ approach in 1987 as an official guidance document and it is now used in risk assessments². This procedure of estimating the toxicity of 2,3,7,8-TCDD and its congeners was applied in EPA 905/488-005, by the State of California's Hazard Evaluation Section, by EPA Region IV in its assessment of dioxin contamination in the Pigeon River System, and in guidance for evaluations by the North Carolina Epidemiology Division. Therefore, this summary presents results of monitoring edible fish tissue fillets near pulp and paper facilities using TEQ's as an indicator of dioxin fish tissue contamination. Furthermore, since the North Carolina Epidemiology Division utilized a value of 3 parts per trillion (mathematical mean) of dioxin as a level at which to recommend fish consumption advisories, the tables presented within the body of this summary have all dioxin values equal to or exceeding the 3 ppt level highlighted. Where dioxin concentrations have been expressed by laboratory reports as non-detected (ND), TEQ levels are assumed to be equal to zero.

Dioxin in Whole Fish Samples

Dioxin concentrations are closely associated with suspended particles in the water column and in sediments. Fish that feed on the bottom of streams in the sediment rich environment are likely to be in close contact with relatively higher concentrations of dioxin. Suckers, carp and chubs are examples of these bottom feeding fish. Dioxin is lipophyllic and is usually found in higher concentrations in whole fish tissue samples. Initially, whole fish samples were chosen to

²U.S. EPA (U.S. Environmental Protection Agency).(1989) Interim Procedures for Estimating Risks Associated with Exposure to Mixtures of Chlorinated Dibenzo-p-Dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016. Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, DC 20460.

provide maximum concentrations of fish tissue contamination at specific locations. Thus, it is not the intent of whole fish dioxin monitoring to determine the consumption suitability of fish. The potential health effects of eating contaminated fish are normally evaluated based on the fillet or edible portion. Therefore, 1990 sampling efforts concentrated almost entirely on fish fillet portions.

Quality Assurance

Concerns for data quality prompted the Division of Environmental Management and the pulp and paper industry to request duplicate laboratory analysis on selected samples. Fourteen pairs of observations are listed in Appendix A. These observations are summarized in Table 1 as TEQ values. Note that paired values generally appear reasonable even though one pair has a difference greater than 50%. These paired observations were tested for normal distribution using the Shapiro-Wilk's test. After Shapiro-Wilk's analysis, which strongly indicated that the paired observations were not normally distributed, Spearman's Test for Rank Correlation was selected to evaluate statistical significance. Spearman's analysis indicated a significant correlation between values at the 99% level of confidence.

Table 1. Paired Observations for Duplicate Sample Analysis From 1990

Observation A	Observation B	Observation A	Observation B
2.7	1.3	16.7	21.5
0.3	0.2	0.4	0.2
0	0	2.4	2.2
0	0	0	0
0.6	0.6	0	0
6.4	6.5	0	0
2.4	1.9	0	0

Weyerhaeuser laboratories represent the only pulp and paper company in North Carolina with their own laboratory capable of performing dioxin analyses. In order to provide an additional level of quality assurance, Weyerhaeuser split seven samples with a dioxin consulting laboratory, Triangle Labs in Research Triangle Park, North Carolina. Results of these split analyses are summarized below (Table 2) as TEQ values. Utilizing the statistical approach as previously described, these paired observations did not indicate a statistically significant correlation between pairs. Note that two of the observations by Weyerhaeuser indicated less than 1 ppt while Triangle Labs indicated values greater than the 3 ppt evaluation level.

Table 2. Results of Split Samples between Weyerhaeuser and Triangle Labs

Observation A - Weyerhaeuser Laboratory	Observation B - Triangle Labs
2.39	1.9
16.72	21.53
0.32	4.59
0	5.14
0	0.1
1.31	2.23
0.17	0.32

Coastal North Carolina Fish Fillet Dioxin Results

Cumulatively, DEM, EPA, and the pulp and paper industry have sampled dioxin in tissue at 73 locations in coastal North Carolina. Most of these locations are illustrated in Figure 2 and listed in Table 3. Within the list of locations sampled for coastal assessments there are six general areas:

Cape Fear River System
Neuse River System
Roanoke River System

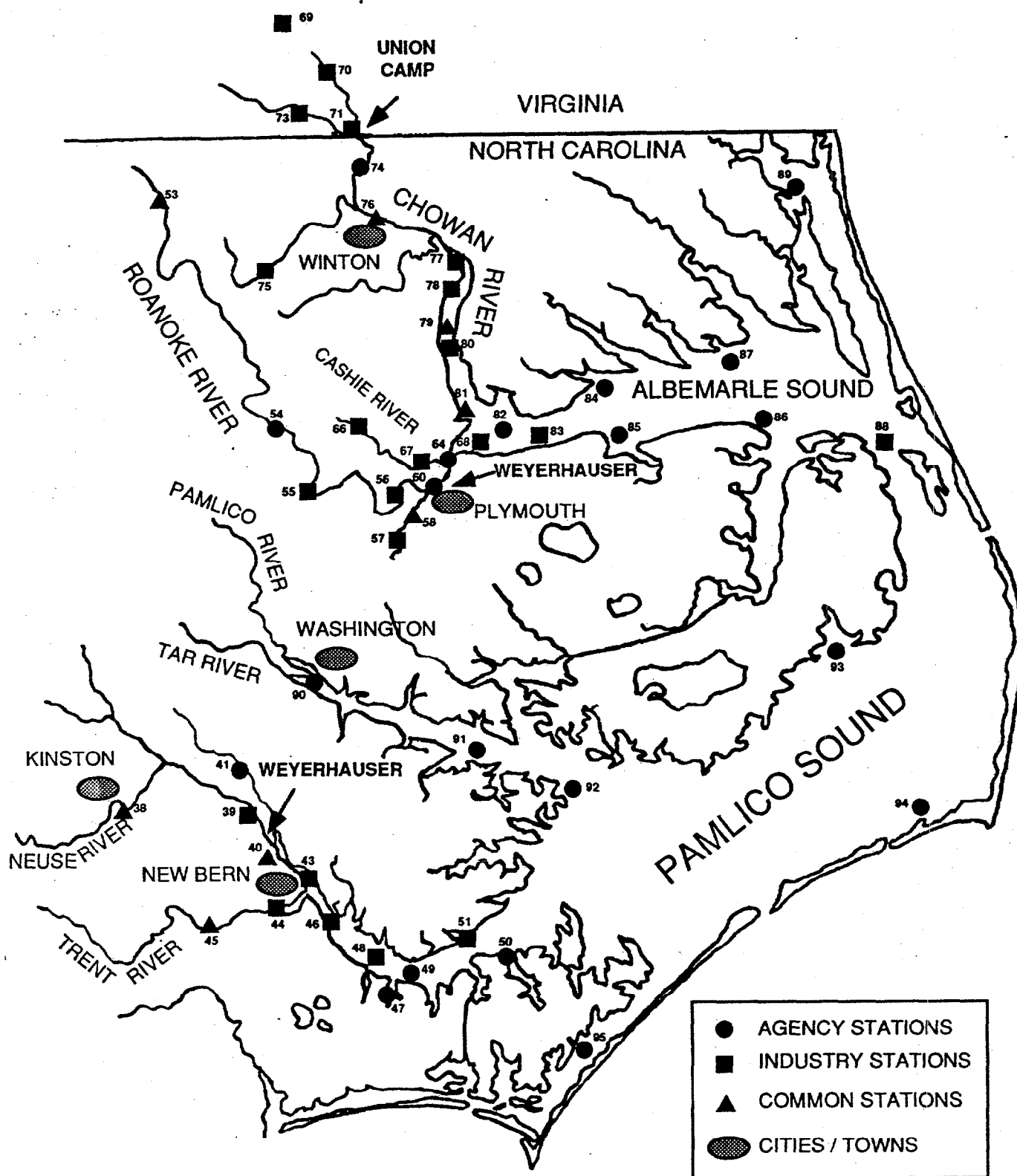
Chowan River System
Albemarle Sound System
Pamlico River System

Each of these general areas are summarized and data from individual locations will be presented in Appendix A and Appendix B.

Table 3. Dioxin Sampling Locations in Coastal North Carolina

<u>Number</u>	<u>Station Location</u>	<u>Number</u>	<u>Station Location</u>
25	Cape Fear River at Elwell's Ferry	61	Middle River at NC 45
26	Cape Fear River above Lock & Dam #1	62	Albemarle Snd @ Terrapin Pt
27	CPF River below Lock and Dam #1	63	Roanoke River at Marker 15
28	CPF River Below Federal Eff 0.25-1.25 miles	64	Roanoke River at Sans Souci
29	CPF River near Bryant Mill Creek	65	Roanoke River at Mouth
30	CPF River Below Federal Eff 4-6 miles	66	Cashie River at Windsor
31	CPF River near Black River Confluence	67	Cashie River at Sans Souci Ferry
32	Black River near Hunts Bluff	68	Albemarle Sound at Marker 1
33	CPF River near Indian Creek	69	Blackwater R. app 15 mi UPS Union Camp discharge
34	CPF River at Wilmington	70	Blackwater R. app 5 mi UPS Union Camp discharge
35	Sturgeon Creek Downstream 74/76	71	Blackwater R. at Union Camp discharge
36	Snows Cut near Wilmington	72	Blackwater Mill Site
37	Contentnea Creek at SR 1606 nr Wilson	73	Nottoway River Below Rt 671
38	Neuse River at Kinston	74	Chowan River at Riddicksville
39	Neuse R at Greens Thoroughfare above Cowpens	75	Meherrin River Rt 258 just below Murfreesboro
40	Neuse River near Weyerhaeuser Eff	76	Chowan River at Winton
41	Swift Creek at Vanceboro	77	Chowan River Near Marker 16
42	Neuse River at Marker 52	78	Chowan River Near Marker 9
43	Neuse River at Marker 38	79	Chowan River at Colerain
44	Trent River at Hayward Creek	80	Chowan River Near Marker 5
45	Trent River at Pollocksville	81	Chowan River Near Hwy 17 Bridge
46	Neuse River at Fairfield Harbor-Ft. Point	82	Albemarle Snd @ Norfolk & Southern
47	Slocum Creek	83	Albemarle Sound at Hwy 32
48	Neuse River at Beard Creek	84	Albemarle Snd @ Harvey's Point
49	Neuse River at Minnesott Beach	85	Albemarle Snd @ Bull Bay
50	South River nr South River	86	Albemarle Sound at Alligator River
51	Neuse River at Oriental	87	Albemarle Snd @ Wade Point
52	Roanoke River at Weldon (Hatch)	88	Albemarle Sound near Manteo
53	Roanoke River at Weldon	89	Currituck Sound at Tull's Bay
54	Roanoke River at Hamilton	90	Pamlico River at Washington
55	Roanoke River at Williamston	91	Pamlico River near South Creek
56	(Roanoke River) Broad Cr. Slough	92	Pamlico River at Mouse Harbor
57	Welch Creek at Highway 64	93	Long Shoal River
58	Welch Creek Old Discharge Trowbridge Rd.	94	Pamlico Sound at Hatteras Island nr Frisco, NC
59	Welsh Cr at old Weyerhauser discharge	95	Core Sound
60	Roanoke River near Weyerhauser discharge		

Figure 2. COASTAL DIOXIN MONITORING STATIONS



OTHER LOCATIONS ARE SHOWN
 IN FIGURES 3, 4, AND 5

The Cape Fear System

(Sampling locations shown in Figure 3)

Fish samples were collected to assess the potential for dioxin contamination of the Cape Fear River above and below the discharge of the Federal Paper Board Company's Reigelwood Operations. Fish fillet analyses during 1990 evaluated 150 individual fish yielding 27 composites (Table 4). The maximum observed value of a fish fillet concentration in this system was recorded from a blue catfish composite of four individuals. This TEQ value, obtained in the summer of 1989, was equal to 1.9 ppt. No observations for fish fillet samples from this system have ever exceeded 3 ppt (Table 5)

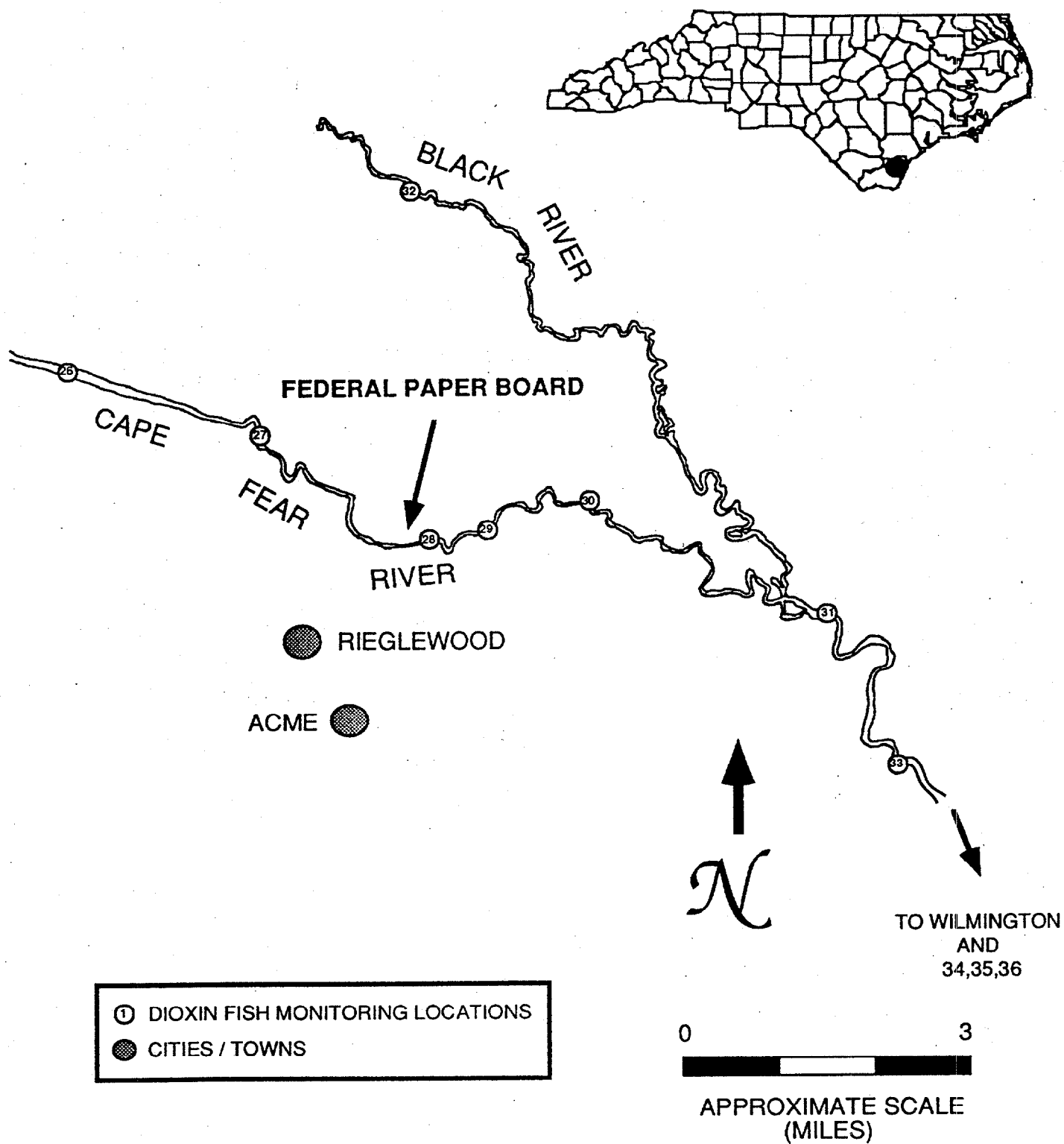
Table 4. Cape Fear River System Dioxin Fish Fillet Summary For 1990

Station Location Number	Station Location	Avg TEQ	Fish Fillet Sampled in 1990			% obs ≥ 3 TEQ
			Num Ind	Num Obs	Num Species	
25	Cape Fear River at Elwell's Ferry	0.0	35	5	4	0
26	Cape Fear River above Lock & Dam #1	-	-	-	-	-
27	CPF River below Lock and Dam #1	0.3	18	3	2	0
28	CPF River Below Federal Eff 0.25-1.25 miles	-	-	-	-	-
29	CPF River near Bryant Mill Creek	0.9	24	5	5	0
30	CPF River Below Federal Eff 4-6 miles	-	-	-	-	-
31	CPF River near Black River Confluence	0.6	38	6	4	0
32	Black River near Hunts Bluff	-	-	-	-	-
33	CPF River near Indian Creek	0.0	24	5	4	0
34	CPF River at Wilmington	0.4	11	3	3	0
35	Sturgeon Creek Downstream 74/76	Whole fish only				
36	Snows Cut near Wilmington	Oysters only				
			150 total	27 total		0 average

Table 5. Cape Fear River System Dioxin Fish Fillet Summary 1984- 1990

Station Location Number	Station Location	Avg TEQ	Fish Fillet Sampled 1984 through 1990			% obs ≥ 3 TEQ
			Num Ind	Num Obs	Num Species	
25	Cape Fear River at Elwell's Ferry	0.0	35	5	4	0
26	Cape Fear River above Lock & Dam #1	0.2	10	4	3	0
27	CPF River below Lock and Dam #1	0.3	18	3	2	0
28	CPF River Below Federal Eff 0.25-1.25 miles	1.0	27	6	5	0
29	CPF River near Bryant Mill Creek	0.9	24	5	5	0
30	CPF River Below Federal Eff 4-6 miles	1.0	14	4	2	0
31	CPF River near Black River Confluence	0.6	38	6	4	0
32	Black River near Hunts Bluff	0.0	16	4	4	0
33	CPF River near Indian Creek	0.0	24	5	4	0
34	CPF River at Wilmington	0.4	11	3	3	0
35	Sturgeon Creek Downstream 74/76	Whole fish only				
36	Snows Cut near Wilmington	Oysters only				
			217 total	45 total		0 average

Figure 3. CAPE FEAR RIVER SYSTEM



The Neuse River System

(Sampling locations are shown in Figures 2 and 4)

Fish samples were collected to assess the potential for dioxin contamination of the Neuse River System near the discharge of the Weyerhaeuser New Bern facility. Fish fillet analyses conducted in 1990 evaluated 430 total individuals yielding 50 composites (Table 6). None of the locations sampled in 1990 had elevated dioxin concentrations (greater than 3 ppt). The maximum TEQ value observed in 1990 from the Neuse system was found in a composite sample of ten white catfish averaging 739 grams in weight. This maximum value was 1.9 ppt expressed as TEQ. This 1990 information is not consistent with dioxin data collected on fillet samples prior to 1990. As seen in Table 7, an average of 58% of all observations from this system prior to 1990 were equal to, or above, the evaluation level of 3 ppt. Many possible explanations for this change could be offered, such as variations in laboratory analyses, difference in fish lipid concentrations, seasonal differences, differences in size and weight, overall fish health and condition, and species variations. Perhaps modifications at the Weyerhaeuser facility to reduce the discharge level of dioxin could also be credited with this apparent decrease in tissue levels. Each of these possibilities, acting alone or in combination, are possible explanations for the between year differences that have been observed. Without additional information, these explanations could only be speculative.

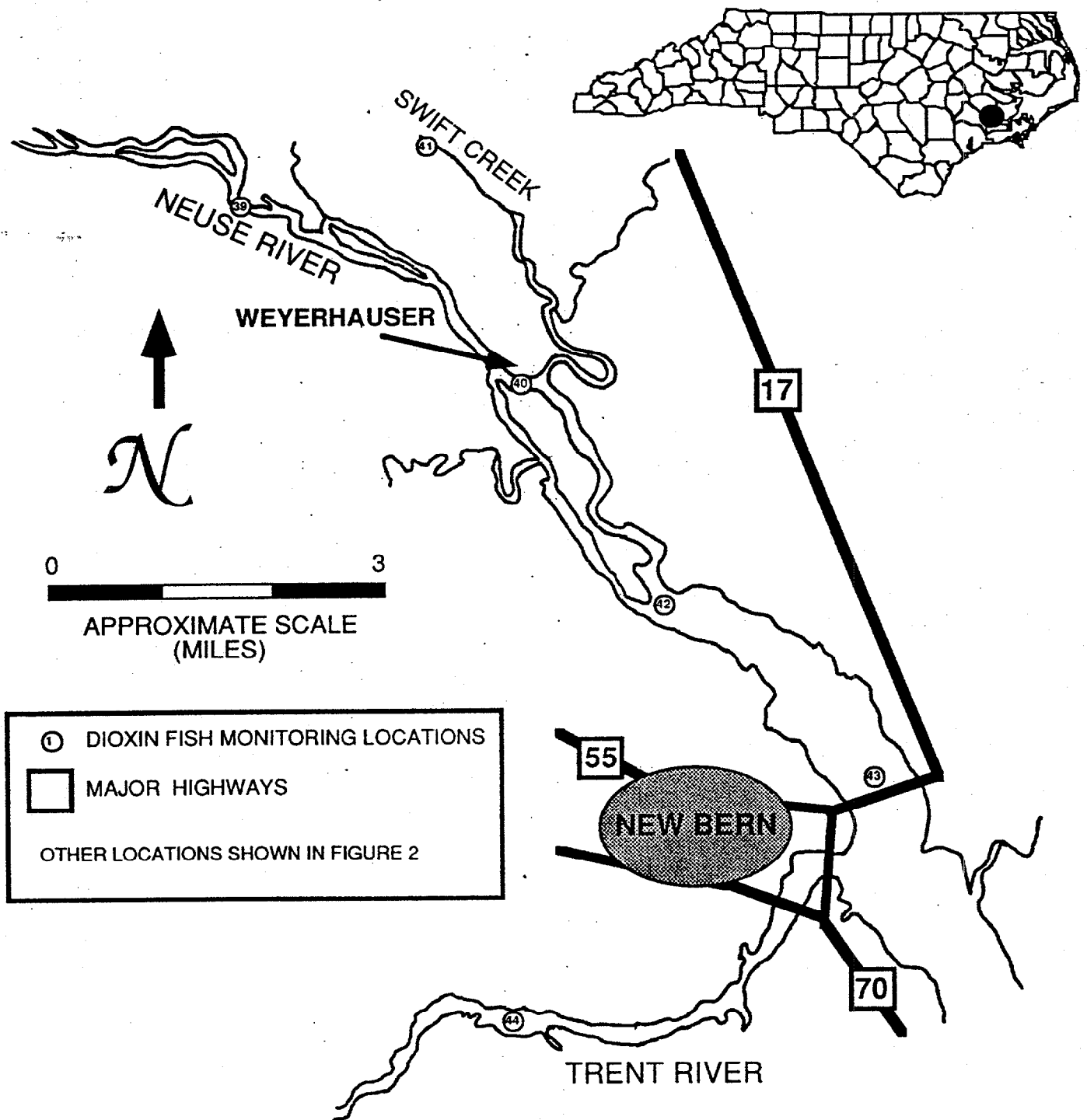
Table 6. Neuse River System Dioxin Fish Fillet Summary For 1990

Station Location Number	Station Location	Avg TEQ	Fish Fillet Sampled in 1990			% obs ≥ 3 TEQ
			Num Ind	Num Obs	Num Species	
38	Neuse River at Kinston	0.0	16	3	3	0
39	Neuse R at Greens Thoroughfare above Cowpens	-	-	-	-	-
40	Neuse River near Weyerhaeuser Eff	0.2	39	6	5	0
41	Swift Creek at Vanceboro	0.7	22	3	3	0
42	Neuse River at Marker 52	0.2	36	5	3	0
43	Neuse River at Marker 38	0.3	53	5	4	0
44	Trent River at Hayward Creek	0.0	60	4	4	0
45	Trent River at Pollocksville	0.1	19	5	4	0
46	Neuse River at Fairfield Harbor-Ft. Point	0.6	42	3	2	0
(47)	Slocum Creek	0.3	31	4	4	0
48	Neuse River at Beard Creek	0.2	23	4	3	0
49	Neuse River at Minnesott Beach	0.4	39	4	3	0
50	South River nr South River	0.3	25	2	2	0
51	Neuse River at Oriental	0.1	25	2	1	0
			430 total	50 total		0 average

Table 7. Neuse River System Dioxin Fish Fillet Prior to 1990

Location Number	Station Location	Avg TEQ	Fish Fillet Sampled 1984 through 1989				% obs ≥ 3 TEQ
			Num Ind	Num Obs	Num Species		
38	Neuse River at Kinston	0.8	7	2	1		0
39	Neuse R at Greens Thoroughfare above Cowpens	6.3	35	7	4		71.4
40	Neuse River near Weyerhaeuser Eff	4.4	38	9	5		33.3
41	Swift Creek at Vanceboro	-	-	-	-		-
42	Neuse River at Marker 52	7.4	29	6	4		83.3
43	Neuse River at Marker 38	-	-	-	-		-
44	Trent River at Hayward Creek	8.8	5	2	2		100
45	Trent River at Pollocksville	-	-	-	-		-
46	Neuse River at Fairfield Harbor-Ft. Point	-	-	-	-		-
47	Slocum Creek	-	-	-	-		-
48	Neuse River at Beard Creek	-	-	-	-		-
49	Neuse River at Minnesott Beach	-	-	-	-		-
50	South River nr South River	-	-	-	-		-
51	Neuse River at Oriental	-	-	-	-		-
			114 total	26 total			58 average

Figure 4. NEUSE RIVER SYSTEM



Roanoke River System

(Sampling locations are shown in Figures 2 and 5)

Fish samples were collected to evaluate the extent of known dioxin contamination of the Roanoke River System above and below the discharge of the Weyerhaeuser facility at Plymouth. Fish fillet analyses in 1990 evaluated 222 total individuals yielding 33 composites (Table 8). None of the locations sampled in 1990 above Williamston, N.C. had average dioxin concentrations above 3 ppt expressed as TEQ. Williamston, N.C. had been previously selected by the State Health Director as the upper bound for a dioxin fish consumption advisory on the Roanoke River. In 1990, fish fillets in Welch Creek and the Roanoke River near the Weyerhaeuser discharge continued to have elevated dioxin concentrations. The maximum TEQ value observed in 1990 from the Roanoke system was found in a composite sample of five channel catfish averaging 1409 grams in weight. This maximum value was 26.4 ppt expressed as TEQ. In general, 1990 dioxin information from the Roanoke system suggests lower fillet values when compared to data collected prior to 1990 (Table 9). Explanations for this change would be consistent with the possibilities mentioned in the Neuse River. Samples collected from the Roanoke River at Weldon (Hatch) in 1988 were made available for testing by staff of the Wildlife Resources Commission as a result of fish hatchery activities on striped bass. The exact origin of these samples was not determined.

Table 8. Roanoke River System Dioxin Fish Fillet Summary For 1990

Station Location Number	Station Location	Fish Fillet Sampled in 1990				
		Avg TEQ	Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
52	Roanoke River at Weldon (Hatch)	-	-	-	-	-
53	Roanoke River at Weldon	0.4	30	4	4	0
54	Roanoke River at Hamilton	0.4	42	5	4	0
55	Roanoke River at Williamston	0.2	37	4	3	0
56	(Roanoke River) Broad Cr. Slough	-	-	-	-	-
57	Welch Creek at Highway 64	-	-	-	-	-
58	Welch Creek Old Discharge Trowbridge Rd.	-	-	-	-	-
59	Welsh Cr at old Weyerhaeuser discharge	6.7	38	7	5	100
60	Roanoke River near Weyerhaeuser discharge	-	-	-	-	-
61	Middle River at NC 45	-	-	-	-	-
62	Albemarle Snd @ Terrapin Pt	-	-	-	-	-
63	Roanoke River at Marker 15	8.0	31	5	4	40
64	Roanoke River at Sans Souci	-	-	-	-	-
65	Roanoke River at Mouth	-	-	-	-	-
66	Cashie River at Windsor	0.4	19	4	4	0
67	Cashie River at Sans Souci Ferry	0.4	25	4	2	0
			222 total	33 total	20 average	

Figure 5. ROANOKE RIVER SYSTEM

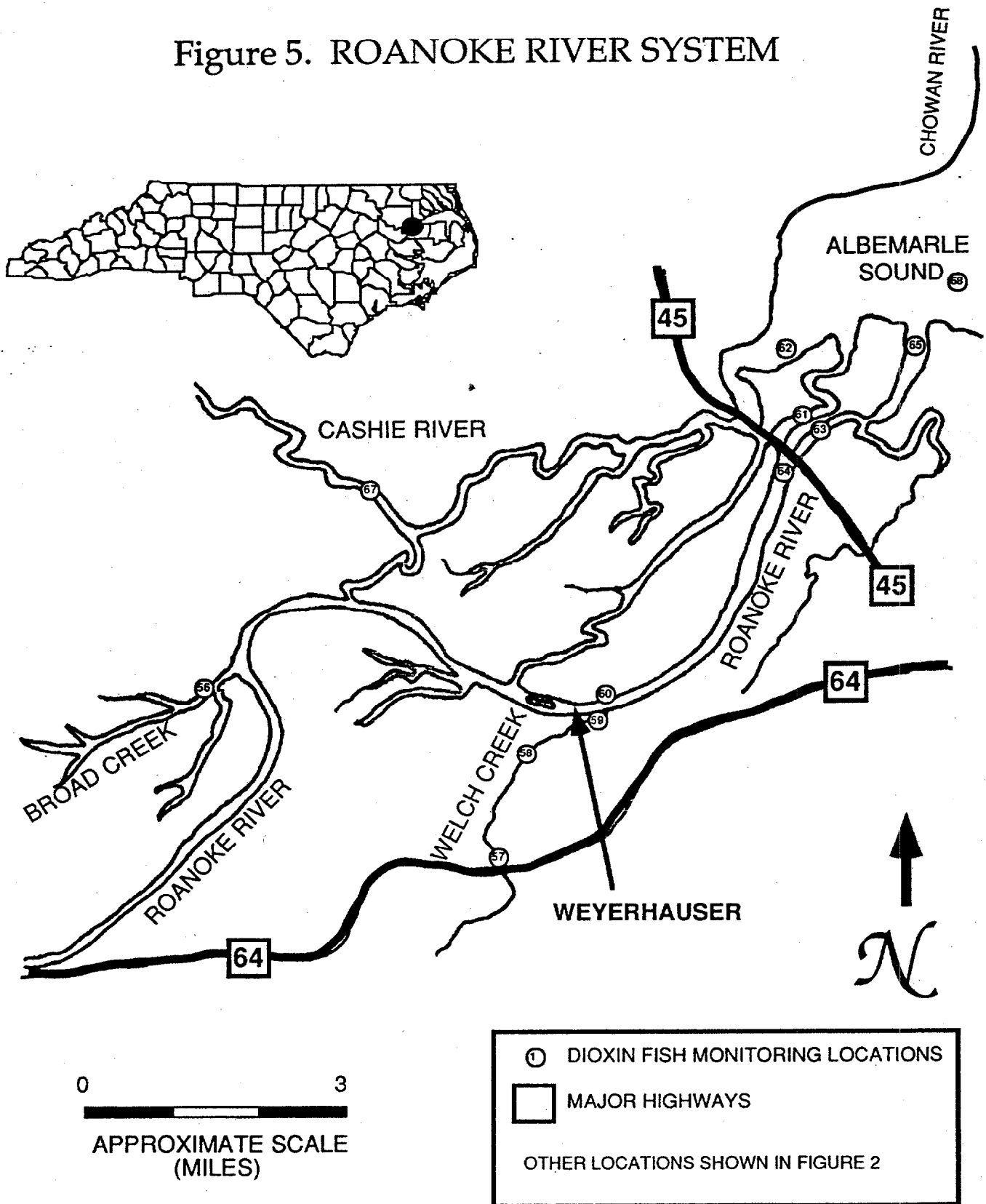


Table 9. Roanoke River System Dioxin Fish Fillet Summary 1987 through 1989

Station Location Number	Station Location	Fish Fillet Sampled 1987 through 1989				% obs ≥ 3 TEQ
		Avg TEQ	Num Ind	Num Obs	Num Species	
52	Roanoke River at Weldon (Hatch)	13.0	5	2	1	100
53	Roanoke River at Weldon	0.2	6	1	1	0
54	Roanoke River at Hamilton	-	-	-	-	-
55	Roanoke River at Williamston	14.6	4	2	2	50
56	(Roanoke River) Broad Cr. Slough	8.0	29	7	4	42.9
57	Welch Creek at Highway 64	6.8	25	5	4	40
58	Welch Creek Old Discharge Trowbridge Rd.	56.5	43	9	6	100
59	Welsh Cr at old Weyerhaeuser discharge	20.3	5	1	1	100
60	Roanoke River near Weyerhaeuser discharge	16.8	31	6	5	100
61	Middle River at NC 45	51.9	6	2	2	100
62	Albemarle Snd @ Terrapin Pt	8.1	3	1	1	100
63	Roanoke River at Marker 15	20.1	56	12	4	100
64	Roanoke River at Sans Souci	17.7	18	6	2	100
65	Roanoke River at Mouth	8.8	13	5	2	80
66	Cashie River at Windsor	-	-	-	-	-
67	Cashie River at Sans Souci Ferry	-	-	-	-	-
			244 total	59 total		78 average

Chowan River System

(Sampling locations are shown in Figure 2)

Fish samples were collected to evaluate the extent of dioxin contamination of the Chowan River System below the discharge of the Union Camp facility located in Virginia. Estuarine hydraulics and fish movements in this area complicate data assessment. Accumulation of dioxin in fish in the lower Chowan River may be associated with the nearby discharge of the Weyerhaeuser Plymouth facility, or the Union Camp facility, or both. Fish fillet analyses during 1990 yielded 30 composites. As of this summary's preparation, the number of individual fish sampled was not available for samples collected by Union Camp (Table 10). Therefore, the total number of individual fish sampled could not be calculated. All locations sampled below Winton, N.C. had average TEQ values greater than the 3 ppt TEQ evaluation level. As in previous sampling efforts (Table 11), dioxin concentrations in channel catfish were most notably elevated; however, 1990 results indicated that dioxin levels in white perch and mullet were also elevated over 3 ppt. At Chowan River at Colerain, a composite sample of 3 mullet fillets had a value of 7.6 TEQ. Four composites of white perch (from 49 individuals) at Highway 17 had values of 9.3, 3.8, 2.5 and 3.8 ppt as TEQs. In 1990, the State Health Director issued a fish consumption advisory on the Chowan River. Insufficient information on other species at the time of issuing this advisory prompted the advisory to include only catfish. New information on additional species should assist in further review of the Chowan River consumption advisories.

Table 10. Chowan River System Dioxin Fish Fillet Summary 1990

Station Location Number	Station Location	Fish Fillet Sampled in 1990				
		Avg TEQ	Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
69	Blackwater R. app 15 mi UPS Union Camp discharge	1.4	-	4	4	25
70	Blackwater R. app 5 mi UPS Union Camp discharge	-	-	-	-	-
71	Blackwater R. at Union Camp discharge	-	-	-	-	-
72	Blackwater Mill Site	1.2	-	1	1	0
73	Nottoway River Below Rt 671	0.6	-	1	1	0
74	Chowan River at Riddicksville	-	-	-	-	-
75	Meherrin River Rt 258 just below Murfreesboro	0.7	-	1	1	0
76	Chowan River at Winton	8.9	-	6	5	16.6
77	Chowan River Near Marker 16	12.9	-	2	2	50
78	Chowan River Near Marker 9	11.3	-	1	1	100
79	Chowan River at Colerain	5.4	29	4	4	50
80	Chowan River Near Marker 5	24.3	-	1	1	100
81	Chowan River Near Hwy 17 Bridge	6.3	-	9	4	66
				30		41
				total		average

Table 11. Chowan River System Dioxin Fish Fillet Summary 1988 through 1989

Station Location Number	Station Location	Fish Fillet Sampled 1988 through 1989				
		Avg TEQ	Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
69	Blackwater R. app 15 mi UPS Union Camp discharge	0.8	-	3	3	0
70	Blackwater R. app 5 mi UPS Union Camp discharge	1.2	-	5	3	0
71	Blackwater R. at Union Camp discharge	1.7	-	2	2	0
72	Blackwater Mill Site	-	-	-	-	-
73	Nottoway River Below Rt 671	2.2	-	1	1	0
74	Chowan River at Riddicksville	0.0	5	1	1	0
75	Meherrin River Rt 258 just below Murfreesboro	23.8	-	1	1	100
76	Chowan River at Winton	15.5	-	15	5	66
77	Chowan River Near Marker 16	1.4	-	1	1	0
78	Chowan River Near Marker 9	25.2	-	1	1	100
79	Chowan River at Colerain	-	-	-	-	-
80	Chowan River Near Marker 5	37.0	-	1	1	100
81	Chowan River Near Hwy 17 Bridge	21.1	-	3	3	66
				34		39
				total		average

Albemarle Sound System

(Sampling locations are shown in Figure 2)

Dioxin concentrations in fish fillets from the Albemarle Sound in 1990 provides the Epidemiology Division additional information to evaluate consumption advisories based on the level of 3 ppt. Data available in 1989, (Table 12), did not have sufficient number of observations on which to base a consumption evaluation. In 1990, 354 individual fish were sampled from the Albemarle Sound System yielding 33 composites. Species sampled included striped bass, spot, channel catfish, white perch, sturgeon, mullet, largemouth bass, croaker and flounder. Striped bass, channel catfish, white perch, and mullet fillets (Table 13) from four locations within the inner-sound area, east of Bull Bay, had elevated observations for dioxin in excess of 3 ppt.

Table 12. Albemarle Sound Fish Fillet Summary for 1989

Station Location Number	Station Location	Avg TEQ	Num Ind	Fish Fillet collected in 1989		
				Num Obs	Num Species	% obs ≥ 3 TEQ
68	Albemarle Sound at Marker 1	-	-	-	-	-
82	Albemarle Sound @ Norfolk & Southern	-	-	-	-	-
83	Albemarle Sound at Hwy 32	-	-	-	-	-
84	Albemarle Sound @ Harvey's Point	8.7	3	1	1	100
85	Albemarle Sound @ Bull Bay	-	-	-	-	-
86	Albemarle Sound at Alligator River	-	-	-	-	-
87	Albemarle Sound @ Wade Point	11.5	5	1	1	100
88	Albemarle Sound near Manteo	-	-	-	-	-

Table 13. Albemarle Sound Fish Fillet Summary for 1990

Station Location Number	Station Location	Avg TEQ	Num Ind	Fish Fillet Sampled in 1990		
				Num Obs	Num Species	% obs ≥ 3 TEQ
68	Albemarle Sound at Marker 1	11.6	42	5	3	80
82	Albemarle Sound @ Norfolk & Southern	6.3	59	6	5	66.6
83	Albemarle Sound at Hwy 32	3.3	57	5	3	40
84	Albemarle Sound @ Harvey's Point	1.6	27	3	3	0
85	Albemarle Sound @ Bull Bay	6.9	34	3	3	66.6
86	Albemarle Sound at Alligator River	0.4	65	5	3	0
87	Albemarle Sound @ Wade Point	2.4	50	4	3	25
88	Albemarle Sound near Manteo	0.1	20	2	2	0
			354	33		35
			total	total		average

Pamlico River System

(Sampling locations are shown in Figure 2)

Two locations in the Pamlico River were sampled to provide comparisons to collections from the Roanoke/Albemarle Sound and Neuse River Systems. There are no pulp and paper mill facilities located on the Pamlico River and no observations exceeded the 3 ppt evaluation level (Table 14.).

Table 14. Pamlico River Fish Fillet Samples from 1990

Station Location Number		Fish Fillet Collected in 1990				% obs ≥ 3 TEQ
		Avg TEQ	Num Ind	Num Obs	Num Species	
90	Pamlico River at Washington	0.2	24	4	4	0
92	Pamlico River at Mouse Harbor	0.1	50	5	4	0
			74 total	9 total		0 average

Crab and Oyster Results

The vast majority of dioxin analyses have been conducted on finfish tissue. Only a few samples have been analyzed for oyster and crab tissue. Two samples were collected for oyster analyses, one from Hatteras Island and one from Snow's Cut on the lower Cape Fear River. These oyster samples indicated dioxin below laboratory detection limits and are not included in any subsequent analyses. Four samples have been analyzed for crab tissues. Two of these samples were analyzed for hepatopancreas tissues and two samples have been analyzed for crab meat. These results are presented in Table 15. All samples had TEQ dioxin values exceeding 3 ppt. Note however, that consumption levels and other assumptions used in risk assessments have not been presented for either crabs or oysters. Criteria for establishing advisory limits for these species may be entirely different than fish tissue criteria.

Table 15. Dioxin analyses of Blue Crabs in North Carolina

Location Number	Location	Date Sampled	Species	Sample Type / #	Dioxin			
					Total TEQ ppt	2378-TCDD ppt	2378-TCDF ppt	% Lipids
60	Roanoke River at Plymouth	10/11/90	Blue Crab	meat/18	6.0*	3.1	29	1.85
82	Albemarle Snd @ Norfolk & Southern	9/6/90	Blue Crab	meat/10	3.4*	2.1	12.6	0.56
95	Core Sound	11/7/89	Blue Crab	HepaPancreas	4.59	1.02	4.6	12.6
91	Pamlico River near South Creek	10/12/89	Blue Crab	HepaPancreas	3.19	0.67	7.42	20

Mountains

French Broad River

(Sampling locations are shown in Figure 6)

Fish tissue samples collected in the French Broad River in 1990 yielded 24 observations. The Ecusta Division of the P.H. Glatfelter facility is located on the French Broad River near the mouth of the Davidson River. During 1990, many fish species were collected including brown trout, rock bass, largemouth bass, smallmouth bass, bullheads, and sunfish. One observation out of four at the upstream sampling location, French Broad River near SR 1129, indicated dioxin contamination. One observation obtained from a composite sample of ten rock bass fillets, collected by Ecusta, had a reporting value for 2,3,7,8 TCDD of 6.4 ppt expressed as EMPC. While the exact concentration of this sample could not be determined due to laboratory difficulties, it was possible to estimate the sample's maximum possible concentration. A copy of the laboratory report for this sample has been requested from Ecusta to further evaluate these results. None of the 1990 observations at the first downstream location, French Broad River at Patton Bridge, had dioxin levels exceeding 3 ppt expressed as TEQ's. At Crab Creek Road, only one observation had a TEQ level exceeding 3 ppt (Table 16). This observation was obtained from a composite sample of 2 yellow bullhead fillets with a value of 9.9 ppt as TEQ's. At Highway 191, 2 observations were greater than the 3 ppt evaluation level. However, these two samples, from bluegill and rock bass fillets, had 2,3,7,8-TCDD levels of 0.92 and 1.2 EMPC respectively. Fish fillet samples collected in 1989 at Patton Bridge had higher levels of dioxins (Table 17).

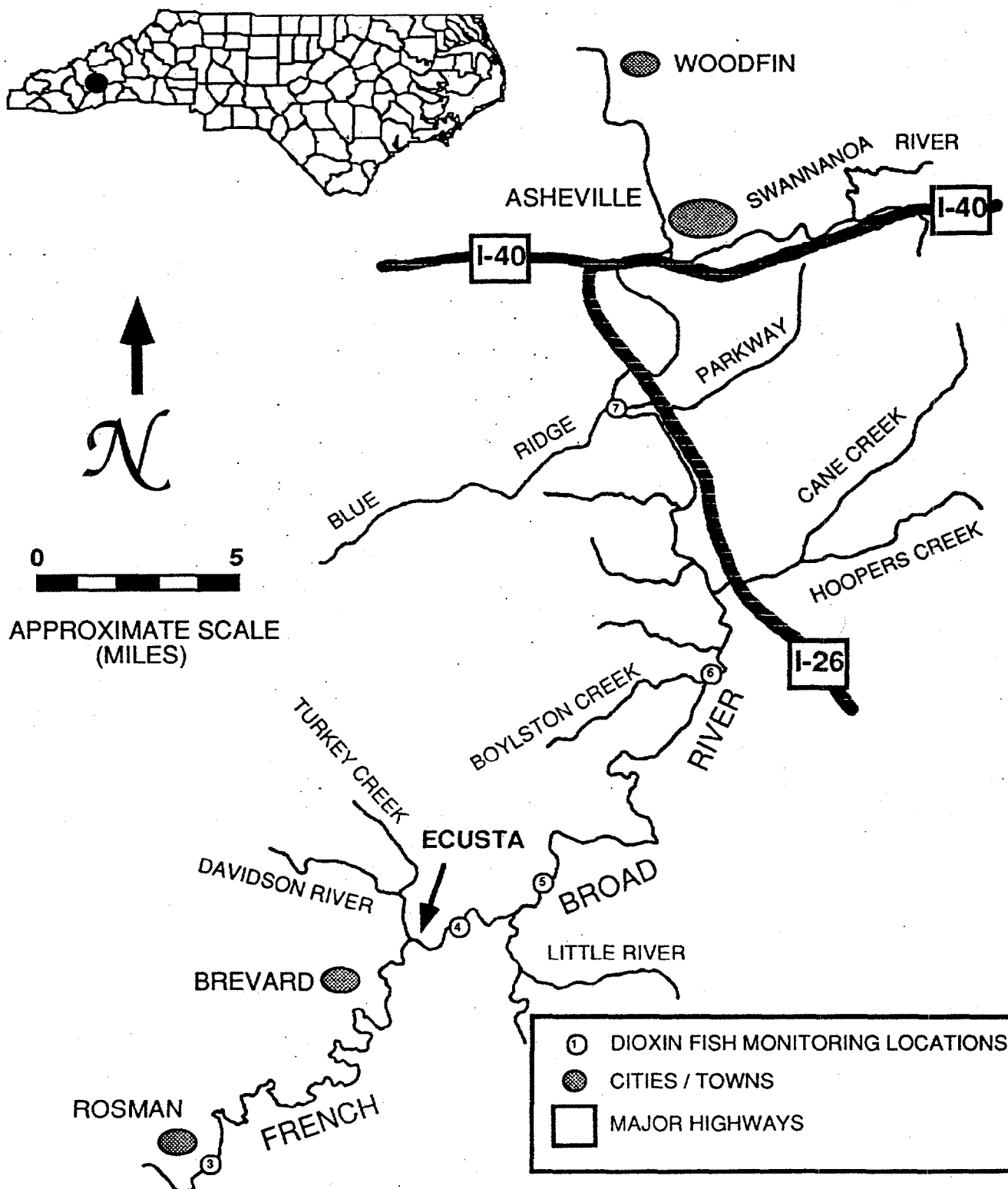
Table 16. French Broad River System Dioxin Fish Fillet Summary For 1990

Station Location Number	Station Location	Fish Fillet Sampled in 1990				
		Avg TEQ	Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
3	French Broad River near SR 1129	1.6	27	4	3	25
4	FBR River at Patton Bridge (Ecusta Olin)	1.3	29	5	4	0
5	French Broad River near Crab Creek Road	3.3	33	5	5	20
6	French Broad River near Hwy 191	1.8	26	5	5	40
7	French Broad River near BR Parkway Bridge	0.4	37	5	3	0
			152 total	24 total		17 average

Table 17. French Broad River System Dioxin Fish Fillet Summary For 1989

Station Location Number	Station Location	Fish Fillet Sampled in 1989				
		Avg TEQ	Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
3	French Broad River near SR 1129	-	-	-	-	-
4	FBR River at Patton Bridge (Ecusta Olin)	19.8	19	6	4	50
5	French Broad River near Crab Creek Road	2.0	35	5	5	40
6	French Broad River near Hwy 191	-	-	-	-	-
7	French Broad River near BR Parkway Bridge	-	-	-	-	-

Figure 6. FRENCH BROAD RIVER SYSTEM



Pigeon River System

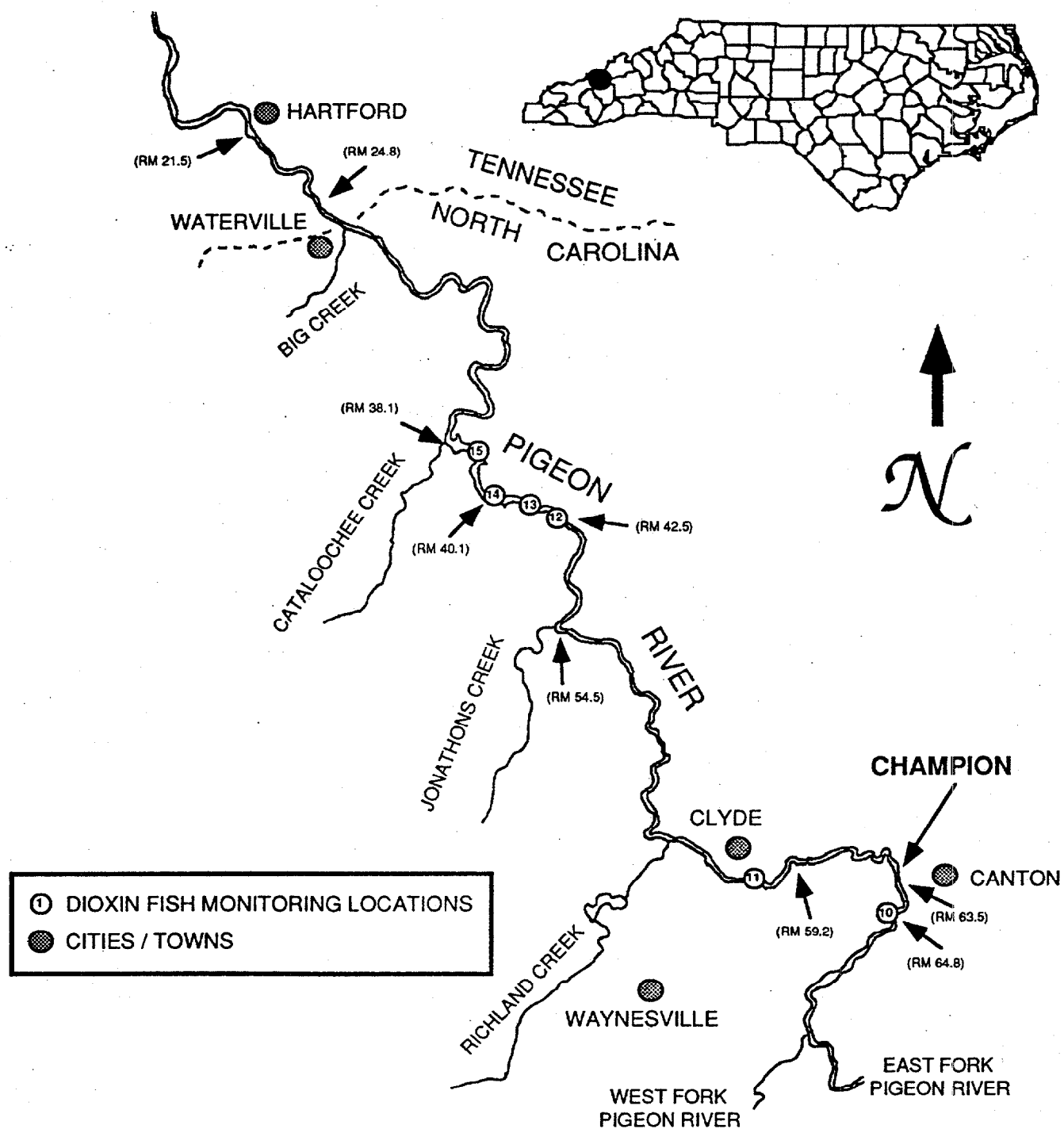
(Sampling locations are shown in Figure 7)

No 1990 dioxin data was evaluated from the Pigeon River as of the writing of this summary. Although some 1990 preliminary results were received from Champion Paper Company, this data indicated some questionable analytical recovery results. Samples are currently being reanalyzed and a summary of these results will be provided at a latter date. Historical data is summarized in Table 18.

Table 18. Pigeon River System Dioxin Fish Fillet Summary For 1987-1988

Station Location Number	Avg TEQ	Fish Fillet Sampled 1987 through 1988			
		Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
10 Pigeon River mile 64.5 above Canton, N.C.	0.0	4	3	3	0
11 Pigeon River mile 58 at Clyde, N.C. at SR 1642	8.7	10	3	3	100
12 Pigeon River mile 41.5 Waterville Reservoir	10.3	8	3	3	100
13 Pigeon River mile 41.25 Waterville Reservoir	9.2	14	5	4	100
14 Pigeon River mile 40 Waterville Reservoir	33.3	8	3	3	100
15 Pigeon River mile 39 Waterville Reservoir	10.0	7	2	2	100
		51 total	19 total		83 average

Figure 7. PIGEON RIVER SYSTEM



Piedmont

Lumber River System

(Sampling locations are shown in Figure 8)

Fish tissue samples collected in the Lumber River in 1990 yielded eleven composites. Collections were made to evaluate the potential accumulation of dioxin in fish fillets as may be a result of the discharge from the Alpha Cellulose facility located near Lumberton. As in 1989, fish were difficult to collect during 1990. Apparently the Lumber River is not densely populated with fish. Only two observations out of eleven exceeded the level of 3 ppt dioxin; both of these samples were obtained at station location 21, Lumber River at Highway 72 near Hestertown. A single fillet, from an 845 gram sucker, had a TEQ value of 5.7; a composite sample of 7 bullhead catfish fillets had a value of 3.4 ppt. Results from 1990, summarized in Table 19, are consistent with results from 1989 (Table 20).

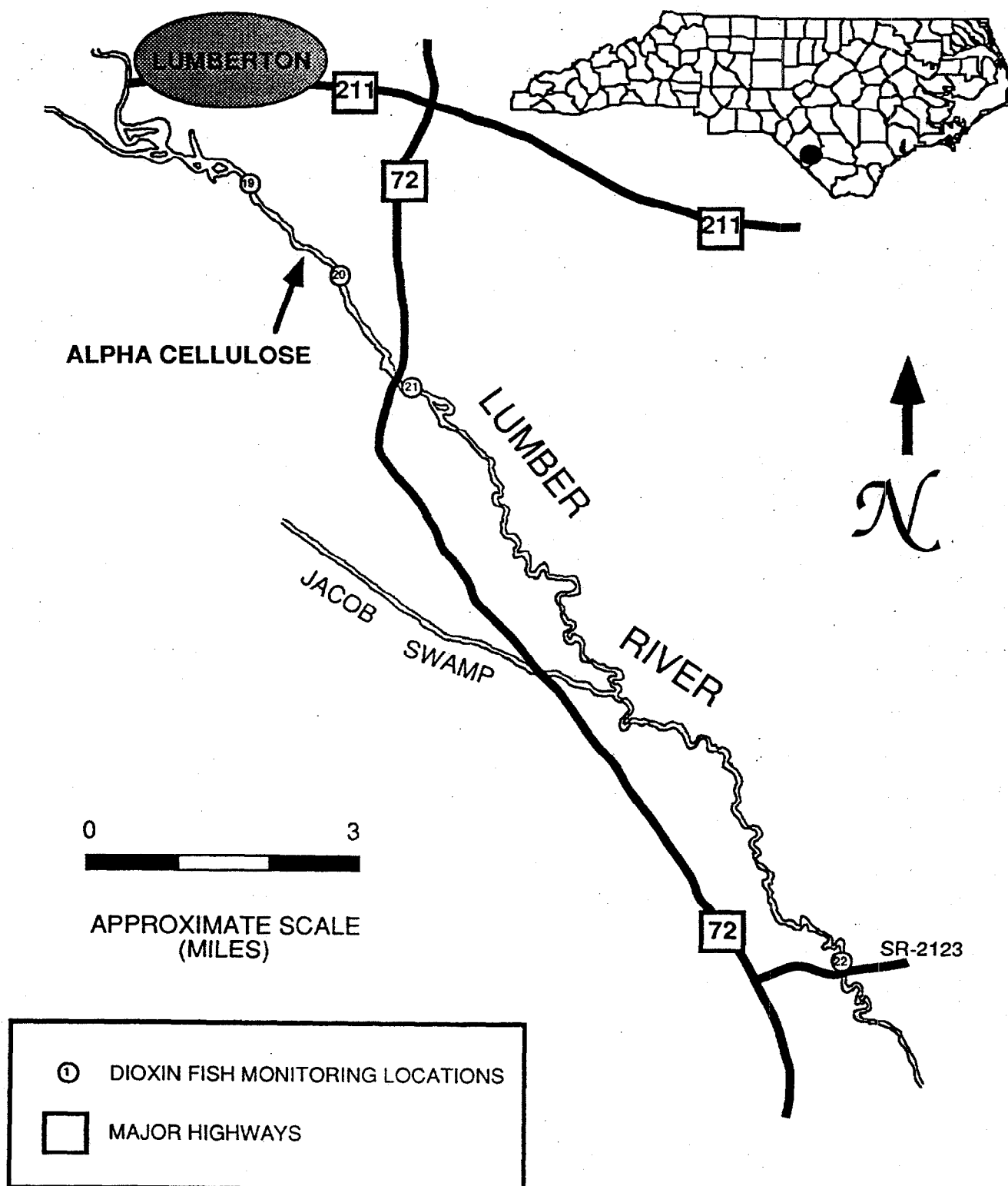
Table 19. Lumber River System Dioxin Fish Fillet Summary For 1990

Station Location Number	Station Location	Avg TEQ	Fish Fillet Collected in 1990			
			Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
19	Lumber River 2 miles UPS Alpha Cellulose	0.4	6	3	2	0
20	Lumber River 1 mi. dns Alpha Cellulose	-	-	-	-	-
21	Lumber River at Hwy 72 nr Hestertown	2.6	31	5	4	40
22	Lumber River 6 miles DNS Alpha Cellulose at SR2123	-	-	-	-	-
23	Lumber River at Hwy 74 nr Boardman	0.6	16	3	3	0
			53 total	11 total		13 average

Table 20. Lumber River System Dioxin Fish Fillet Summary For 1989

Station Location Number	Station Location	Avg TEQ	Fish Fillet Collected in 1989			
			Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
19	Lumber River 2 miles UPS Alpha Cellulose	0.2	2	1	1	0
20	Lumber River 1 mi. dns Alpha Cellulose	1.8	15	7	5	28.6
21	Lumber River at Hwy 72 nr Hestertown	-	-	-	-	-
22	Lumber River 6 miles DNS Alpha Cellulose at SR2123	0.1	8	3	5	0
23	Lumber River at Hwy 74 nr Boardman	-	-	-	-	-
			25 total	11 total		10 average

Figure 8. LUMBER RIVER SYSTEM



Monitoring Summary

Since 1987, approximately 1,800 individual fish have been collected for analyses at more than 90 monitoring locations throughout North Carolina. In response to evaluating potential fish consumption issues, sampling activities conducted in 1990, accounted for 1,390 of these individual fish. Compositing these individual fish prior to analyses yielded 194 dioxin samples. To date over 500 dioxin fish tissue analyses have been completed in North Carolina. The majority of these observations have been located in the proximity of pulp and paper effluent discharges in coastal waters. Fish tissue analyses were conducted at 56 locations in 1990, with 13 of these sampling sites indicating average dioxin concentrations greater than the 3 ppt evaluation level (Table 21). Only 5 other sampling locations had any individual observations greater than the 3 ppt evaluation level (Table 22). Results obtained from duplicate laboratory samples and from samples split between laboratories indicate acceptable laboratory results for data analyzed in 1990.

Table 21. Sampling Locations with mean TEQ's Greater than 3ppt.

Station Location Number		Avg TEQ	1990 Fish Tissue Summary			
			Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
Mountains						
5	French Broad River near Crab Creek Road	3.3	33	5	5	20
Coast						
59	Welsh Cr at old Weyerhauser discharge	6.7	38	7	5	100
63	Roanoke River at Marker 15	8.0	31	5	4	40
68	Albemarle Sound at Marker 1	11.6	42	5	3	80
76	Chowan River at Winton	8.9		6	5	16.6
77	Chowan River Near Marker 16	12.9		2	2	50
78	Chowan River Near Marker 9	11.3		1	1	100
79	Chowan River at Colerain	5.4	29	4	4	50
80	Chowan River Near Marker 5	24.3		1	1	100
81	Chowan River Near Hwy 17 Bridge	6.3		9	4	66
82	Albemarle Snd @ Norfolk & Southern	6.3	59	6	5	66.6
83	Albemarle Sound at Hwy 32	3.3	57	5	3	40
85	Albemarle Snd @ Bull Bay	6.9	34	3	3	66.6

Table 22. Sampling Locations with Individual Observations Greater than 3ppt but Station average TEQ's less than 3ppt.

Station Location Number		1990 Fish Tissue Summary				
		Avg TEQ	Num Ind	Num Obs	Num Species	% obs ≥ 3 TEQ
Mountains						
3	French Broad River near SR 1129	1.6	27	4	3	25
6	French Broad River near Hwy 191	1.8	26	5	5	40
Coast						
21	Lumber River at Hwy 72 nr Hestertown	2.6	31	5	4	40
69	Blackwater R. app 15 mi UPS Union Camp discharge	1.4		4	4	25
87	Albemarle Snd @ Wade Point	2.4	50	4	3	25

While fiscal limitations have allowed only a few data points at any one location, the cooperation of the pulp and paper industry, the Division of Marine Fisheries and the Wildlife Resources Commission have resulted in an effective assessment. The Division of Environmental Management (DEM) will continue monitoring dioxin in fish tissue as resources allow and will continue to report results to all interested parties. Wastewater discharge permits administered by DEM will mandate dioxin reduction strategies and require annual fish tissue monitoring for pulp and paper facilities discharging to impacted surface waters.

Appendix A

Summary of Individual Dioxin Fish Tissue Samples

Summary of Individual Dioxin Fish Tissue Samples

Station Number	BY	Location	Date Sampled	Species	Sample Type / #	Average weight g	Dioxin Total TEQ ppt	2378-TCDD ppt	2378-TCDF ppt	% Lipids
Mountains										
1	A	Nantahala River at Macon Co.	5/27/87	Walleye	fillet / 2	990	0	ND	ND	
1	A	Nantahala River at Macon Co.	5/27/87	White Sucker	whole / 2	1113	0.23	ND	1.88	
2	A	Cataloochee Cr.	10/17/84	Rainbow	fillet/13	127	2.42	2.26	0.9	
2	A	Cataloochee Cr.	10/17/84	Str. Roller etc	whole/14	25	0*	ND		
3	S	French Broad River near SR 1129	Sept 25-26, 1990	Brown Trout	fillet/2	418	0*	ND	0.36	2.57
3	S	French Broad River near SR 1129	Sept 25-26, 1990	Rock Bass	fillet/10	116	0*	ND	0.24	1.41
3	S	French Broad River near SR 1129	Sept 25-26, 1990	Rock Bass	fillet/10	80	6.5*	EMPC(6.4)	0.58	1.14
3	S	French Broad River near SR 1129	Sept 25-26, 1990	Northern Hogsucker	fillet/5	160	0*	ND	0.32	0.63
4	A	FBR River at Patton Bridge (Ecusta Olin)	11/3/87	Largemouth Bass	fillet/1	210	2.1	1.44	1.39	
4	A	FBR River at Patton Bridge (Ecusta Olin)	11/3/87	Bl Rh Sucker	whole/6	347	18.7	5.5	93.71	
4	S	FBR River at Patton Bridge (Ecusta Olin)	April 4-6, 1989	Brown Trout	Whole/1	800	82.5	20.93	482.61	
4	S	FBR River at Patton Bridge (Ecusta Olin)	April 4-6, 1989	Black Redhorse	Whole/5	582	19.1	4.077	122.61	
4	S	FBR River at Patton Bridge (Ecusta Olin)	April 4-6, 1989	Muskellunge	Fillet/1	262	20.5	2.853	155.87	
4	S	FBR River at Patton Bridge (Ecusta Olin)	April 4-6, 1989	Redbreast Sunfish	Fillet/13	56	2.4	1.083	7.125	
4	S	FBR River at Patton Bridge (Ecusta Olin)	April 4-6, 1989	Largemouth Bass	Fillet/1	81	2.2	0.978	0.983	
4	S	FBR River at Patton Bridge (Ecusta Olin)	April 4-6, 1989	Northern Hog Sucker	Whole/4	192	16.4	4.448	86.781	
4	S	FBR River at Patton Bridge (Ecusta Olin)	April 4-6, 1989	Flat Bullhead	Fillet/2	258	9.3	2.697	22.968	
4	S	FBR River at Patton Bridge (Ecusta Olin)	Sept 26-28, 1990	Redbreast Sunfish	fillet/12	82	0.9*	0.64	2.4	3.3
4	S	FBR River at Patton Bridge (Ecusta Olin)	Sept 26-28, 1990	Rock Bass	fillet/10	58	0.8*	0.38	4.6	0.99
4	S	FBR River at Patton Bridge (Ecusta Olin)	Sept 26-28, 1990	Largemouth Bass	fillet/1	468	0.7*	EMPC(0.61)	1.3	2.11
4	S	FBR River at Patton Bridge (Ecusta Olin)	Sept 26-28, 1990	Flat Bullhead	fillet/3	72	2.7*	2.4	3.3	6.72
4	S	FBR River at Patton Bridge (Ecusta Olin)	Sept 26-28, 1990	Flat Bullhead	fillet/3	72	1.3*(dup)	1.1	2.4	5.84
5	S	French Broad River near Crab Creek Road	April 6-7, 1989	Black Redhorse	Whole/4	603	13.9	2.561	90.308	
5	S	French Broad River near Crab Creek Road	April 6-7, 1989	Black Redhorse	Whole/4	597	6.7	1.499	41.603	
5	S	French Broad River near Crab Creek Road	April 6-7, 1989	Smallmouth Bass	Fillet/1	524	4.1	0.963	13.457	
5	S	French Broad River near Crab Creek Road	April 6-7, 1989	Rock Bass	Fillet/4	114	1.1	0.269	6.702	
5	S	French Broad River near Crab Creek Road	April 6-7, 1989	Flat Bullhead	Fillet/7	48	3.6	1.296	3.962	
5	S	French Broad River near Crab Creek Road	April 6-7, 1989	Bluegill	Fillet/5	22	0.5	0.295	0.388	
5	S	French Broad River near Crab Creek Road	April 6-7, 1989	Redbreast Sunfish	Fillet/16	41	0.9	0.256	3.843	
5	S	French Broad River near Crab Creek Road	Sept 25-28, 1990	Bluegill	fillet/7	98	2.3*	1.3	9.8	7.68
5	S	French Broad River near Crab Creek Road	Sept 25-28, 1990	Rock Bass	fillet/11	113	1.6*	EMPC(0.60)	9.5	0.87
5	S	French Broad River near Crab Creek Road	Sept 25-28, 1990	Redbreast Sunfish	fillet/12	102	1.3*	0.87	4.2	2.69
5	S	French Broad River near Crab Creek Road	Sept 25-28, 1990	Flat Bullhead	fillet/3	164	1.5*	1.1	3.8	3.94
5	S	French Broad River near Crab Creek Road	Sept 25-28, 1990	Yellow Bullhead	fillet/2	685	9.9*	8.9	10.2	10.94
6	S	French Broad River near Hwy 191	Sept 24-28, 1990	Redbreast Sunfish	fillet/10	76	1.2*	0.82	4.2	1.44
6	S	French Broad River near Hwy 191	Sept 24-28, 1990	Bluegill	fillet/7	75	3.4*	0.82	25	1.54
6	S	French Broad River near Hwy 191	Sept 24-28, 1990	Rock Bass	fillet/3	73	3.2*	EMPC(1.2)	19.5	1.44
6	S	French Broad River near Hwy 191	Sept 24-28, 1990	Flat Bullhead	fillet/3	143	1.0*	0.72	2.3	2.03
6	S	French Broad River near Hwy 191	Sept 24-28, 1990	Yellow Bullhead	fillet/3	1081	0.4*	ND	3.9	1.12
7	S	French Broad River near BR Parkway Bridge	Sept 24-27, 1990	Rock Bass	fillet/11	96	0.6*	EMPC(0.46)	1.5	3.17
7	S	French Broad River near BR Parkway Bridge	Sept 24-27, 1990	Redbreast Sunfish	fillet/8	61	0.5*	EMPC(0.40)	1.2	1.79
7	S	French Broad River near BR Parkway Bridge	Sept 24-27, 1990	Redbreast Sunfish	fillet/8	59	0.4*	EMPC(0.37)	0.38	0.61
7	S	French Broad River near BR Parkway Bridge	Sept 24-27, 1990	Flat Bullhead	fillet/5	71	0.5*	EMPC(0.41)	0.61	1.45
7	S	French Broad River near BR Parkway Bridge	Sept 24-27, 1990	Flat Bullhead	fillet/5	109	0.2*	ND	1.9	1.82
8	A	FBR at Marshall	10/17/84	Hogsucker	whole/2	235	0*	ND		
9	A	Yackin River Patterson	9/1/88	Redhorse Sucker	whole/5	390	1.8	1.38	3.92	
9	A	Lake Hickory	10/11/84	Carp	fillet/2	4076	0*	ND		
9	A	Lake Hickory	10/11/84	White Bass	fillet/2	617	0*	ND		
9	A	Lake Hickory	10/11/84	Carp	whole/1	4416	1.5*	1.5		
9	A	Lake Hickory	10/11/84	Largemouth Bass	whole/5	132	0*	ND		
10	A	Pigeon River mile 64.5 above Canton, N.C.	4/18/88	Rock Bass	fillet/2	112.5	0*	ND	ND	
10	A	Pigeon River mile 64.5 above Canton, N.C.	4/18/88	Green Sunfish	fillet/1	78.2	0*	ND	ND	
10	A	Pigeon River mile 64.5 above Canton, N.C.	4/18/88	North. Hogsucker	fillet/1	360	0*	ND	ND	
10	A	Pigeon River mile 64.5 above Canton, N.C.	4/18/88	White Sucker	whole/2	709	0.79	0.25	EMPC(3.2)	
11	A	Pigeon River mile 58 at Clyde, N.C. at SR 1642	11/2/87	Bluegill	fillet/3	113	7.7	7.2	EMPC(5.2)	
11	A	Pigeon River mile 58 at Clyde, N.C. at SR 1642	11/2/87	Carp	fillet/1	325	5.8	5.2	EMPC(5.6)	
11	A	Pigeon River mile 58 at Clyde, N.C. at SR 1642	11/2/87	White Sucker	whole/2	200	92.1	75.7	145.38	
11	A	Pigeon River mile 58 at Clyde, N.C. at SR 1642	11/2/87	Redbreast Sunfish	fillet/6	83	12.6*	12.62		
12	A	Pigeon River mile 41.5 Waterville Reservoir	4/19/88	Largemouth Bass	fillet/5	811	10	9.6	EMPC(5.8)	
12	A	Pigeon River mile 41.5 Waterville Reservoir	4/19/88	Black Bullhead	fillet/2	673.5	10	10	ND	
12	A	Pigeon River mile 41.5 Waterville Reservoir	4/19/88	Smallmouth Bass	fillet/1	879	11	10	EMPC(5.8)	
13	A	Pigeon River mile 41.25 Waterville Reservoir	4/19/88	Muskie	fillet/1	2948	10	7.4	EMPC(26)	
13	A	Pigeon River mile 41.25 Waterville Reservoir	4/19/88	Black Crappie	fillet/5	125	8.4	7.5	EMPC(8.7)	
13	A	Pigeon River mile 41.25 Waterville Reservoir	4/19/88	White Sucker	whole/1	510	2.3	1.9	EMPC(3.2)	
13	A	Pigeon River mile 41.25 Waterville Reservoir	4/19/88	Carp	whole/5	1174	36	34	EMPC(6.1)	
13	A	Pigeon River mile 41.25 Waterville Reservoir	4/20/88	Black Bullhead	fillet/2	694.5	3.4	3.4	ND	
13	A	Pigeon River mile 41.25 Waterville Reservoir	4/19/88	Largemouth Bass	fillet/5	819	12	11	EMPC(4.8)	
13	A	Pigeon River mile 41.25 Waterville Reservoir	4/19/88	Largemouth Bass	fillet/1	1191	12	11	EMPC(5.6)	
14	A	Pigeon River mile 40 Waterville Reservoir	4/19-20/88	Black Bullhead	fillet/5	592	7.9	7.9	ND	
14	A	Pigeon River mile 40 Waterville Reservoir	4/19/88	White Sucker	whole/2	397	51	38	EMPC(110)	
14	A	Pigeon River mile 40 Waterville Reservoir	4/20/88	Brown Trout	fillet/1	5486	80	78	EMPC(10)	
14	A	Pigeon River mile 40 Waterville Reservoir	4/19-20/88	Largemouth Bass	fillet/2	510.5	12	11	EMPC(7.6)	
15	A	Pigeon River mile 39 Waterville Reservoir	4/19/88	Black Bullhead	fillet/4	437.5	13	13	ND	
15	A	Pigeon River mile 39 Waterville Reservoir	4/20/88	Carp	whole/1	1899	39	37	EMPC(5.7)	
15	A	Pigeon River mile 39 Waterville Reservoir	4/20/88	Black Crappie	fillet/3	94	6.9	6	EMPC(7.2)	
15	A	Pigeon River mile 39 Waterville Reservoir	4/20/88	Brown Trout	whole/2	104.5	0*	ND	ND	

S= Industry Monitored, A=Agency ND=non-detected EMPC=Estimated Maximum Potential Concentration

Summary of Individual Dioxin Fish Tissue Samples

Station Number	BY	Location	Date Sampled	Species	Sample Type / #	Average weight g	Dioxin Total TEQ ppt	2378-TCDD ppt	2378-TCDF ppt	% Lipids
Piedmont										
16	A	Pee Dee R. at Hydro	9/10/84	Largemouth Bass	whole/2	968	0*	ND		
17	A	Deep R below Ramseur Dam	5/19/87	Largemouth Bass	fillet / 5	650	0.67	0.48	ND	
17	A	Deep R below Ramseur Dam	5/19/87	Rh Sucker	whole / 2	1210	5.67	1.53	4.37	
18	A	Haw R at Saxapahaw	5/18/87	Largemouth Bass	fillet / 5	684	0.13	ND	0.31	
18	A	Haw R at Saxapahaw	5/15/89	Largemouth Bass	fillet/5	510	0.464	EMPC(0.28)	0.48	
18	A	Haw R at Saxapahaw	5/15/89	Largemouth Bass	fillet/5	1245	0.4 E	0.27	0.34	
18	A	Haw R at Saxapahaw	5/18/87	Carp	whole / 4	3853	12.9	5.66	4.61	
19	S	Lumber River 2 miles UPS Alpha Cellulose	June/July, 1989	Carp	whole/2	5660	5.5	2.7	14.7	
19	S	Lumber River 2 miles UPS Alpha Cellulose	June/July, 1989	Carp	whole/2	7493	7.2	EMPC3.9	16.6	
19	S	Lumber River 2 miles UPS Alpha Cellulose	June/July, 1989	Largemouth Bass	fillet/2	665	0.2	ND	1.5	
19	S	Lumber River 2 miles UPS Alpha Cellulose	Sept 15-Oct 16, 1990	Bream	fillet/3	145.6	0*	ND	0.2	4.68
19	S	Lumber River 2 miles UPS Alpha Cellulose	Sept 15-Oct 16, 1990	Bullhead Catfish	fillet/1	262	0.5*	EMPC(0.49)	0.33	3.4
19	S	Lumber River 2 miles UPS Alpha Cellulose	Sept 15-Oct 16, 1990	Bullhead Catfish	fillet/2	429	0.6*	0.64	ND	2.48
20	A	Lumber River 1 mi. dns Alpha Cellulose	12/2/87	White Cat	fillet/1	2250	2.7 + 50%	1.5	3.9	
20	A	Lumber River 1 mi. dns Alpha Cellulose	12/2/87	Bluegill	fillet/4	185	0	ND	ND	
20	A	Lumber River 1 mi. dns Alpha Cellulose	12/2/87	Spotted Sucker	Whole/3	2333	2	2.7	24.54	
20	S	Lumber River 1 mi. dns Alpha Cellulose	June/July, 1989	Bull Headed Catfish	whole/1	1070	2.5	EMPC1.5	5.1	
20	S	Lumber River 1 mi. dns Alpha Cellulose	June/July, 1989	Bluegill	fillet/2	355	0.5	ND	4.2	
20	S	Lumber River 1 mi. dns Alpha Cellulose	June/July, 1989	Sunfish	fillet/3	873	3.9	1	23	
20	S	Lumber River 1 mi. dns Alpha Cellulose	June/July, 1989	Sunfish	fillet/3	320	0.8	0.45	3.2	
20	S	Lumber River 1 mi. dns Alpha Cellulose	June/July, 1989	Redear Sunfish	fillet/1	90	0.5	0.28	1.8	
20	S	Lumber River 1 mi. dns Alpha Cellulose	June/July, 1989	Spotted Sucker	whole/2	1155	7.1	2.8	35	
20	S	Lumber River 1 mi. dns Alpha Cellulose	June/July, 1989	Bowfin	fillet/1	2400	4.4	1.3	25.1	
21	S	Lumber River at Hwy 72 nr Hestertown	Sept 15-Oct 16, 1990	Sucker	fillet/1	845	5.7*	3.1	26.3	15.15
21	S	Lumber River at Hwy 72 nr Hestertown	Sept 15-Oct 16, 1990	Bullhead Catfish	fillet/5	317.2	1.3*	0.92	3.5	4.6
21	S	Lumber River at Hwy 72 nr Hestertown	Sept 15-Oct 16, 1990	Bullhead Catfish	fillet/7	193.6	3.4*	3.3	1.1	6.69
21	S	Lumber River at Hwy 72 nr Hestertown	14-Nov-90	Largemouth Bass	fillet/10	730.1	1.9*	1.5	EMPC(4.10)	6.02
21	S	Lumber River at Hwy 72 nr Hestertown	14-Nov-90	Redbreast	fillet/8	179.5	0.8*	0.78	0.59	2.33
22	S	Lumber River 6 miles DNS Alpha Cellulose at SR212	June/July, 1989	LMB/Flier	fillet/2	305	0.1	ND	0.45	
22	S	Lumber River 6 miles DNS Alpha Cellulose at SR212	June/July, 1989	Bull Headed Catfish	whole/1	1070	1.6*	EMPC1.5	0.51	
22	S	Lumber River 6 miles DNS Alpha Cellulose at SR212	June/July, 1989	Crappie/Sunfish	fillet/3	194	0.2	ND	1.3	
22	S	Lumber River 6 miles DNS Alpha Cellulose at SR212	June/July, 1989	Carp	whole/1	275	1.8	0.64	0.88	
22	S	Lumber River 6 miles DNS Alpha Cellulose at SR212	June/July, 1989	Catfish	whole/4	371	0.4	0.23	0.84	
22	S	Lumber River 6 miles DNS Alpha Cellulose at SR212	June/July, 1989	Bowfin/sunfish/Flier	fillet/3	405	0.0	ND	0.34	
23	S	Lumber River at Hwy 74 nr Boardman	Sept 15-Oct 16, 1990	Bream	fillet/6	110.3	0.4*	EMPC(0.26)	1.2	5.98
23	S	Lumber River at Hwy 74 nr Boardman	Sept 15-Oct 16, 1990	Black Crappie	fillet/2	267	0.9*	0.7	2.1	11.31
23	S	Lumber River at Hwy 74 nr Boardman	Sept 15-Oct 16, 1990	Bullhead Catfish	fillet/6	269.2	0.5*	0.4	1.2	8.04
24	A	Medlins Pond nr Morrisville	5/29/87	Largemouth Bass	fillet / 4	216	5.52	2.83	ND	
24	A	Medlins Pond nr Morrisville	5/29/87	Bluegill	whole / 6	153	16.14	7.27	ND	
Coast										
25	S	Cape Fear River at Elwell's Ferry	14-Sep-90	Largemouth Bass	fillet/10	267	0*	ND	ND	1.35
25	S	Cape Fear River at Elwell's Ferry	14-Sep-90	Bluegill	fillet/10	77	0*	ND	ND	0.6
25	S	Cape Fear River at Elwell's Ferry	14-Sep-90	Bluegill	fillet/10	57	0*	ND	ND	0.6
25	S	Cape Fear River at Elwell's Ferry	14-Sep-90	Flathead Catfish	fillet/2	1013	0*	ND	ND	0.45
25	S	Cape Fear River at Elwell's Ferry	Sept 14-16, 1990	Blue Catfish	fillet/3	1063	0*	ND	ND	0.25
26	S	Cape Fear River above Lock & Dam #1	May 1-June 6, 1989	Largemouth Bass	Fillet/2	435	ND	ND	ND	
26	S	Cape Fear River above Lock & Dam #1	May 1-June 6, 1989	Bluegill	Fillet/2	129	0.025	ND	0.25	
26	S	Cape Fear River above Lock & Dam #1	May 1-June 6, 1989	Bluegill	Fillet/5	74	ND	ND		
26	S	Cape Fear River above Lock & Dam #1	May 1-June 6, 1989	Chain pickerel	Fillet/1	256	ND	ND		
26	S	Cape Fear River above Lock & Dam #1	May 1-June 6, 1989	Carp	Whole/2	2800	1.0	0.9		
26	S	Cape Fear River above Lock & Dam #1	May 1-June 6, 1989	Blue Catfish	Whole/4	772	ND	ND		
27	A	CPF River below Lock and Dam #1	9/4/90	Channel Catfish	fillet/4	451	0.3*	EMPC(0.32)	0.29	3.93
27	A	CPF River below Lock and Dam #1	9/4/90	Channel Catfish	fillet/4	451	0.2*(dup)	EMPC(0.19)	0.19	2.49
27	A	CPF River below Lock and Dam #1	9/4/90	Bluegill	fillet/10	91	0.4*	EMPC(0.35)	0.41	1.5
28	A	CPF River Below Federal Eff 0.25-1.25 miles	10/28/87	Largemouth Bass	fillet/5		0.9	0.93	ND	
28	A	CPF River Below Federal Eff 0.25-1.25 miles	10/28/87	Carp	whole/1		24.3	22.3	3.34	
28	A	CPF River Federal Paper Eff 0.25-1.25 miles	10/28/87	Channel Catfish	whole/1	300	1.8	1.7	0.39	
28	S	CPF River Below Federal Eff 0.25-1.25 miles	May 1-June 6, 1989	Longear sunfish	Fillet/3	73	1.0	0.97	0.7	
28	S	CPF River Below Federal Eff 0.25-1.25 miles	May 1-June 6, 1989	Bluegill	Fillet/8	106	1.1	1.1	0.4	
28	S	CPF River Below Federal Eff 0.25-1.25 miles	May 1-June 6, 1989	Bluegill	Fillet/5	123	0.8	0.74	0.27	
28	S	CPF River Below Federal Eff 0.25-1.25 miles	May 1-June 6, 1989	Flathead Catfish	Fillet/2	212	0.4	0.44	ND	
28	S	CPF River Below Federal Eff 0.25-1.25 miles	May 1-June 6, 1989	Blue Catfish	Fillet/4	870	1.9	1.9	ND	
28	S	CPF River Below Federal Eff 0.25-1.25 miles	May 1-June 6, 1989	Channel Catfish	Whole/3	408	6.6	6.5	0.65	
28	S	CPF River Below Federal Eff 0.25-1.25 miles	May 1-June 6, 1989	Carp	Whole/3	2150	1.7	1.4	2.7	
29	S	CPF River near Bryant Mill Creek	11-Sep-90	Largemouth Bass	fillet/3	571	0.8*	0.77	0.36	0.75
29	S	CPF River near Bryant Mill Creek	Sept 11-15, 1990	Bluegill	fillet/10	110	1.4*	1.3	0.95	1.5
29	S	CPF River near Bryant Mill Creek	15-Sep-90	Redear Sunfish	fillet/7	50	0.8*	0.77	0.73	0.7
29	S	CPF River near Bryant Mill Creek	11-Sep-90	Flathead Catfish	fillet/1	802	0.5*	0.51	0.086	0.4
29	S	CPF River near Bryant Mill Creek	11-Sep-90	Blue Catfish	fillet/3	1580	1.0*	0.97	0.086	1.2
30	S	CPF River Below Federal Eff 4-6 miles	May 1-June 6, 1989	Largemouth Bass	Fillet/2	687	1.4	1.4	0.17	
30	S	CPF River Below Federal Eff 4-6 miles	May 1-June 6, 1989	Largemouth Bass	Fillet/2	745	0.6	0.63	ND	
30	S	CPF River Below Federal Eff 4-6 miles	May 1-June 6, 1989	Bluegill	Fillet/5	146	1.0	0.9	0.36	
30	S	CPF River Below Federal Eff 4-6 miles	May 1-June 6, 1989	Bluegill	Fillet/5	199	1.0	0.96	0.35	

S= Industry Monitored, A=Agency ND=non-detected EMPC=Estimated Maximum Potential Concentration

Summary of Individual Dioxin Fish Tissue Samples

Station Number	BY	Location	Date Sampled	Species	Sample Type / #	Average weight g	Dioxin Total TEQ ppt	2378-TCDD ppt	2378-TCDF ppt	% Lipids
30	S	CPF River Below Federal Eff 4-6 miles	May 1-June 6, 1989	Carp	Whole/5	2460	1.8	1.8	ND	
30	S	CPF River Below Federal Eff 4-6 miles	May 1-June 6, 1989	Flathead Catfish	Whole/3	202	5.5	5.1	4	
31	S	CPF River near Black River Confluence	Sept 13-17, 1990	Largemouth Bass	fillet/9	465	0.3*	0.31	0.17	0.4
31	S	CPF River near Black River Confluence	Sept 12-17, 1990	Bluegill	fillet/10	78	0.8*	0.71	0.56	0.95
31	S	CPF River near Black River Confluence	Sept 13-17, 1990	Redear Sunfish	fillet/10	70	0.4*	0.42	0.29	0.45
31	S	CPF River near Black River Confluence	17-Sep-90	Redear Sunfish	fillet/6	57	0.5*(sub)	0.44	0.37	0.5
31	S	CPF River near Black River Confluence	Sept 12-13, 1990	Flathead Catfish	fillet/2	582	0.4*	0.37	ND	0.2
31	S	CPF River near Black River Confluence	18-Sep-90	Flathead Catfish	fillet/1	4250	1.3*	1.3	0.33	4.5
32	S	Black River near Hunts Bluff	May 1-June 6, 1989	Largemouth Bass	Fillet/3	759	ND	ND		
32	S	Black River near Hunts Bluff	May 1-June 6, 1989	Yellow perch	Fillet/4	232	ND	ND		
32	S	Black River near Hunts Bluff	May 1-June 6, 1989	Redear Sunfish	Fillet/5	364	ND	ND		
32	S	Black River near Hunts Bluff	May 1-June 6, 1989	Bluegill	Fillet/4	166	ND	ND		
32	S	Black River near Hunts Bluff	May 1-June 6, 1989	Spotted Sucker	Whole/4	868	0.6	0.52		
32	S	Black River near Hunts Bluff	May 1-June 6, 1989	Golden Redhorse	Whole/5	452	ND	ND		
33	S	CPF River near Indian Creek	Sept 13-18, 1990	Largemouth Bass	fillet/6	456	0*	ND	0.32	0.5
33	S	CPF River near Indian Creek	Sept 13-18, 1990	Bluegill	fillet/8	110	0*	ND	0.42	1.1
33	S	CPF River near Indian Creek	Sept 17-18, 1990	Redear Sunfish	fillet/6	52	0*	ND	ND	0.4
33	S	CPF River near Indian Creek	Sept 16-18, 1990	Flathead Catfish	fillet/3	731	0*	ND	ND	0.15
33	S	CPF River near Indian Creek	17-Sep-90	Flathead Catfish	fillet/1	3075	0*	ND	ND	2.75
34	A	CPF River at Wilmington	9/19/90	Atl. Sturgeon	fillet/4	669	0.7*	0.54	EMPC(1.7)	1.77
34	A	CPF River at Wilmington	9/19/90	Flathead Catfish	fillet/4	1345	0.3*	0.33	ND	0.81
34	A	CPF River at Wilmington	9/19/90	Blue Catfish	fillet/3	215	0.3*	EMPC(0.33)	ND	0.4
35	A	Sturgeon Creek Downstream 74/76	2/24/88	Redhorse Sucker	whole/2	500	0.8 + - 50%	0.66	0.37	
36	A	Snows Cut near Wilmington	10/30/84	Oysters	meat		ND	ND		
37	A	Contentnea Creek at SR 1806 nr Wilson	10/19/87	Largemouth Bass	whole/3	960	1.5 + - 50%	1	1.3	
38	A	Neuse River at Kinston	10/23/84	Largemouth Bass	fillet/1	2400	1.55	0.86	0.82	
38	A	Neuse River at Kinston	11/5/87	Largemouth Bass	fillet/6	400	0.03	ND	0.3	
38	A	Neuse River at Kinston	10/23/84	Redhorse Sucker	whole/1	1349	5.17	2.01	13.45	
38	S	Neuse River at Kinston	July 26-Aug 1, 1990	Bluegill	fillet/7	145.3	0*	ND(0.06)	ND(0.11)	5
38	S	Neuse River at Kinston	Oct 4-16, 1990	Channel Catfish	fillet/7	652	0*	ND(0.09)	ND(0.12)	3.5
38	S	Neuse River at Kinston	Aug 1-Oct 10, 1990	White Catfish	fillet/2	1496	0*	ND(0.40)	ND(0.13)	3.3
39	S	Neuse R at Greens Thoroughfare above Cowpens	Mr-May 1989	Brown Bullhead	fillet/5	914	1.3	1.264	ND	
39	S	Neuse R at Greens Thoroughfare above Cowpens	Mr-May 1989	Brown Bullhead	fillet/5	877	3.5	3.412	ND	
39	S	Neuse R at Greens Thoroughfare above Cowpens	Mr-May 1989	White Catfish	fillet/5	1331	11.4	10.528	2.361	
39	S	Neuse R at Greens Thoroughfare above Cowpens	Mr-May 1989	White Catfish	fillet/4	496	10.1	9.533	4.684	
39	S	Neuse R at Greens Thoroughfare above Cowpens	Mr-May 1989	Blue Catfish	fillet/6	31	7.2	7.171	0.4	
39	S	Neuse R at Greens Thoroughfare above Cowpens	Mr-May 1989	Blue Catfish	fillet/5	79	9.9	9.55	0.407	
39	S	Neuse R at Greens Thoroughfare above Cowpens	Mr-May 1989	Pumpkinseed	fillet/5	112	0.8	0.728	0.316	
40	A	Neuse River near Weyerhaeuser Eff	9/1/88	Largemouth Bass	fillet/3	383	6.58	5.48	10.96	
40	A	Neuse River near Weyerhaeuser Eff	9/1/88	Redhorse Sucker	whole/6	975	79.1	49.19	273.81	
40	S	Neuse River near Weyerhaeuser Eff	Mr-May 1989	Brown Bullhead	fillet/4	182	4.8	4.604	1.573	
40	S	Neuse River near Weyerhaeuser Eff	Mr-May 1989	Brown Bullhead	fillet/4	182	3.3	3.125	1.866	
40	S	Neuse River near Weyerhaeuser Eff	Mr-May 1989	Brown Bullhead	fillet/5	182	3.7 dup	3.414	2.428	
40	S	Neuse River near Weyerhaeuser Eff	Mr-May 1989	Bluegill	fillet/5	106	7.0	6.807	2.277	
40	S	Neuse River near Weyerhaeuser Eff	Mr-May 1989	Pumpkinseed	fillet/4	98	0.5	0.44	ND	
40	S	Neuse River near Weyerhaeuser Eff	Mr-May 1989	Pumpkinseed	fillet/4	98	2.5(dup)	2.372	2.428	
40	S	Neuse River near Weyerhaeuser Eff	Mr-May 1989	Largemouth Bass	fillet/5	400	9.7	9.124	5.312	
40	S	Neuse River near Weyerhaeuser Eff	Mr-May 1989	Yellow Perch	fillet/4	106	1.4	1.139	2.047	
40	S	Neuse River near Weyerhaeuser Eff	June 19-Aug 16, 1990	Bluegill	fillet/10	201.4	0.9*	0.88	ND(0.19)	4.7
40	S	Neuse River near Weyerhaeuser Eff	Aug 23-Oct 3, 1990	Channel Catfish	fillet/6	377.2	0*	ND(0.27)	ND(0.22)	2.8
40	S	Neuse River near Weyerhaeuser Eff	Aug 23-Oct 3, 1990	Channel Catfish	fillet/6	377.2	0*(dup)	ND(0.11)	ND(0.23)	3
40	S	Neuse River near Weyerhaeuser Eff	June 19-July 10, 1990	Pumpkinseed	fillet/12	74.2	0.1*	0.08	0.22	2.8
40	S	Neuse River near Weyerhaeuser Eff	11-Jul-90	Striped Bass	fillet/2	675.5	0*	ND(0.23)	ND(0.38)	4.1
40	S	Neuse River near Weyerhaeuser Eff	Aug 23-Oct 3, 1990	White Catfish	fillet/3	179.3	0*	ND(0.27)	ND(0.65)	2.1
41	A	Swift Creek at Vanceboro	9/5/90	Bluegill	fillet/4	156	0.1*	EMPC(0.11)	0.16	0.76
41	A	Swift Creek at Vanceboro	9/5/90	White Catfish	fillet/10	739	1.9*	1.8	0.91	1.99
41	A	Swift Creek at Vanceboro	9/5/90	Largemouth Bass	fillet/8	495	0*	ND	ND	0.31
42	S	Neuse River at Marker 52	Mr-May 1989	Brown Bullhead	fillet/4	618	10.7	10.165	4.057	
42	S	Neuse River at Marker 52	Mr-May 1989	Brown Bullhead	fillet/4	894	4.8	4.555	1.475	
42	S	Neuse River at Marker 52	Mr-May 1989	White Catfish	fillet/5	645	14.1	13.355	3.62	
42	S	Neuse River at Marker 52	Mr-May 1989	Bluegill	fillet/5	157	7.3	7.125	1.658	
42	S	Neuse River at Marker 52	Mr-May 1989	Pumpkinseed	fillet/5	70	2.7	2.585	1.602	
42	S	Neuse River at Marker 52	Mr-May 1989	Pumpkinseed	fillet/6	87	4.5	4.216	3.016	
42	S	Neuse River at Marker 52	July 11-Aug 21, 1990	Black Crappie	fillet/12	204.9	0*	ND(1.1)	ND(1.2)	2.4
42	S	Neuse River at Marker 52	June 19-Aug 21, 1990	Pumpkinseed	fillet/9	75.1	0.9*	0.77	1	2.7
42	S	Neuse River at Marker 52	July 11-Aug 27, 1990	White Catfish	fillet/5	318.8	0.2*	0.14	0.31	2.8
42	S	Neuse River at Marker 52	Aug 21-24, 1990	White Catfish	fillet/5	256.4	0*	ND(0.10)	ND(0.06)	3.4
42	S	Neuse River at Marker 52	Aug 21-24, 1990	White Catfish	fillet/5	256.4	0*(dup)	ND(0.16)	ND(0.10)	3.1
43	S	Neuse River at Marker 38	June 27-Aug 18, 1990	Pumpkinseed	fillet/6	67.8	0*	ND(0.19)	0.22	3.6
43	S	Neuse River at Marker 38	3-Oct-90	Southern Flounder	fillet/3	335.7	0*	ND(0.32)	ND(0.34)	3.5
43	S	Neuse River at Marker 38	July 10-Aug 18, 1990	Spot	fillet/27	36.9	0*	ND(0.22)	0.46	3.8
43	S	Neuse River at Marker 38	2-Oct-90	Striped Mullet	fillet/16	680.7	1.3*	0.71	6	12.4
43	S	Neuse River at Marker 38	3-Oct-90	White Catfish	fillet/1	478	0*	ND(0.45)	ND(0.04)	4.1
44	S	Trent River at Hayward Creek	Mr-May 1989	Pumpkinseed	fillet/4	190	4.2	4.041	1.705	
44	S	Trent River at Hayward Creek	Mr-May 1989	White Perch	fillet/1	696	13.4	10.324	29.689	
44	S	Trent River at Hayward Creek	16-Oct-90	Largemouth Bass	fillet/16	486.1	0*	ND(0.11)	ND(0.22)	3.3
44	S	Trent River at Hayward Creek	July 25-Oct 16, 1990	Pumpkinseed	fillet/20	82.7	0*	ND(0.08)	ND(0.07)	5.3

S= Industry Monitored, A=Agency ND=non-detected EMPC=Estimated Maximum Potential Concentration

Summary of Individual Dioxin Fish Tissue Samples

Station Number	BY	Location	Date Sampled	Species	Sample Type / #	Average weight g	Dioxin Total TEC ppt	2378-TCDD ppt	2378-TCDF ppt	% Lipids
44	S	Trent River at Hayward Creek	July 25-Oct 16, 1990	White Catfish	fillet/2	251	0*	ND(0.18)	ND(0.07)	3
44	S	Trent River at Hayward Creek	July 25-Oct 16, 1990	White Perch	fillet/22	227.9	0*	ND(0.20)	ND(0.36)	4.4
45	S	Trent River at Pollockville	July 24-Oct 16, 1990	Largemouth	fillet/5	615.6	0*	ND(0.13)	ND(0.34)	2.9
45	S	Trent River at Pollockville	24-Jul-90	Redbreast	fillet/2	241	0*	ND(0.22)	ND(0.09)	4.1
45	S	Trent River at Pollockville	July 24-Oct 16, 1990	White Catfish	fillet/2	587	0.6*	0.62	ND(0.65)	2.8
45	A	Trent River at Pollockville	9/6/90	Redear Sunfish	fillet/3	57	0*	ND	0.16	0.51
45	A	Trent River at Pollockville	9/6/90	Largemouth Bass	fillet/7	698	0*	ND	ND	1.07
46	S	Neuse River at Fairfield Harbor-Ft. Point	30-Oct-90	Flounder	fillet/6	259.5	0*	ND(0.11)	ND(0.33)	3.4
46	S	Neuse River at Fairfield Harbor-Ft. Point	Oct 16-25, 1990	Striped Mullet	fillet/18	463.8	0.4*	ND(0.14)	4.4	11.7
46	S	Neuse River at Fairfield Harbor-Ft. Point	Oct 10-25, 1990	Striped Mullet	fillet/18	480	0.9*	0.43	4.9	13.8
46	S	Neuse River at Fairfield Harbor-Ft. Point	16-Oct-90	Striped Mullet-Roe	1	537	1.0*	ND(0.39)	9.5	21.8
47	A	Slocum Creek	9/6/90	Mullet	fillet/12	550	1.0*	0.68	3.2	17.94
47	A	Slocum Creek	9/6/90	Black Crappie	fillet/10	233	0.2*	EMPC(0.13)	0.44	0.46
47	A	Slocum Creek	9/6/90	Largemouth Bass	fillet/6	529	0*	ND	ND	0.96
47	A	Slocum Creek	9/6/90	Flounder	fillet/3	206	0*	ND	ND	0.21
48	S	Neuse River at Beard Creek	16-Oct-90	Croaker	fillet/5	88.8	0*	ND(0.04)	ND(0.55)	12.2
48	S	Neuse River at Beard Creek	16-Oct-90	Spot	fillet/4	112.8	0.2*	ND(0.12)	2.1	9.4
48	S	Neuse River at Beard Creek	Oct 10-16, 1990	Spot	fillet/5	444.5	0.1*	ND(0.17)	1.4	7.4
48	S	Neuse River at Beard Creek	16-Oct-90	Striped Mullet	fillet/9	332.6	0.4*	ND(0.43)	4.4	4
49	A	Neuse River at Minnesott Beach	9/7/90	Croaker	fillet/10	251	0*	ND	0.27	4.72
49	A	Neuse River at Minnesott Beach	9/7/90	Mullet	fillet/9	420	0.7*	EMPC(0.49)	2.3	9.93
49	A	Neuse River at Minnesott Beach	9/7/90	Spot	fillet/10	143	0.8*	EMPC(0.57)	2.3	6.79
49	A	Neuse River at Minnesott Beach	9/7/90	Flounder	fillet/10	421	0.2*	EMPC(0.14)	0.43	0.69
50	A	South River nr South River	9/18/90	Spot	fillet/17	160	0.6*	0.45	1.5	10.72
50	A	South River nr South River	9/18/90	Croaker	fillet/8	226	0*	ND	ND	7.69
51	S	Neuse River at Oriental	Oct 16-17, 1990	Spot	fillet/13	163.1	0*	ND(0.25)	ND(0.91)	11.2
51	S	Neuse River at Oriental	16-Oct-90	Spot	fillet/12	156	0.2*	ND(0.07)	1.6	11.1
52	A	Roanoke River at Weldon (Hatch)	5/6/89	Striped Bass	fillet/1	2640	14.7	12.1	22.2	
52	A	Roanoke River at Weldon (Hatch)	5/6/89	Striped Bass	fillet/4	745	11.2	8.2	27.4	
53	A	Roanoke River at Weldon	9/5/90	Channel Catfish	fillet/9	627	0.5*	EMPC(0.49)	0.52	2.98
53	A	Roanoke River at Weldon	9/5/90	White Catfish	fillet/10	256	0*	ND	EMPC(0.15)	0.41
53	A	Roanoke River at Weldon	9/5/90	Largemouth Bass	fillet/3	366	0.8*	0.72	1.1	20.96
53	A	Roanoke River at Weldon	9/5/90	Bluegill	fillet/8	111	0.4*	EMPC(0.32)	0.47	1.84
53	S	Roanoke River at Weldon	11/21/89	Redbreast Sunfish	Fillet/6	94.3	0.2*	EMPC(0.20)	0.22	
54	A	Roanoke River at Hamilton	9/5/90	Largemouth Bass	fillet/11	648	0.6*	EMPC(0.50)	0.54	1.51
54	A	Roanoke River at Hamilton	9/5/90	Largemouth Bass	fillet/11	648	0.6*(dup)	0.52	0.67	1.55
54	A	Roanoke River at Hamilton	9/5/90	Bluegill	fillet/10	131	0*	ND	ND	0.66
54	A	Roanoke River at Hamilton	9/5/90	Channel Catfish	fillet/2	960	0*	ND	0.26	3.48
54	A	Roanoke River at Hamilton	9/5/90	White Catfish	fillet/8	693	0.7*	0.65	EMPC(0.35)	0.55
55	S	Roanoke River at Williamston	Oct 2,4,6,1989	Black Crappie	Fillet/3	276.3	0.9*	0.68	2	
55	S	Roanoke River at Williamston	10/6/89	Channel Catfish	Fillet/1	475	28.3*	27.5	8.3	
55	S	Roanoke River at Williamston	Sept 28-Oct 7, 1990	Black Crappie	fillet/7	315	0*	ND(0.11)	0.22	4.14
55	S	Roanoke River at Williamston	Oct 6-7, 1990	Black Crappie	fillet/10	140	0*	ND(0.12)	0.25	3.02
55	S	Roanoke River at Williamston	June 8-Oct 6, 1990	Channel Catfish	fillet/6	721	0.6*	0.57	ND(0.27)	4.09
55	S	Roanoke River at Williamston	Oct 6-7, 1990	White Catfish	fillet/14	235	0*	ND(0.46)	ND(0.26)	2.94
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	Bluegill	Fillet/7	38	0.6	0.566	0.372	
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	Bluegill	Fillet/2	212	0.06	ND	0.247	
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	Black Crappie	Fillet/5	289	14.2	11.339	27.002	
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	Black Crappie	Fillet/4	152	1.9	0.974	0.485	
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	White Perch	Fillet/4	256	34.7	27.469	68.472	
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	White Perch	Fillet/4	182	4.1	3.735	3.608	
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	Yellow Perch	Fillet/3	64	0.1	ND	0.607	
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	Chubsucker	Whole/2	441	1.4	1.248	0.614	
56	S	(Roanoke River) Broad Cr. Slough	April/May 1989	Gizzard Shad	Whole/3	406	43.4	24.337	188.157	
57	S	Welch Creek at Highway 64	April/May 1989	Bluegill	Fillet/5	161	20.7	18.658	20.332	
57	S	Welch Creek at Highway 64	April/May 1989	Black Crappie	Fillet/6	347	10.7	9.064	16.355	
57	S	Welch Creek at Highway 64	April/May 1989	Largemouth Bass	Fillet/5	947	0.9	0.654	0.696	
57	S	Welch Creek at Highway 64	April/May 1989	Herring	Whole/5	175	12.7	7.613	48.137	
57	S	Welch Creek at Highway 64	April/May 1989	Gizzard Shad	Whole/5	194	69.6	38.922	305.982	
57	S	Welch Creek at Highway 64	April/May 1989	Chub Sucker	Whole/4	536	81.2	76.07	47.885	
57	S	Welch Creek at Highway 64	10/23/89	Warmouth	Fillet/4	82.5	0.5*	EMPC(0.45)	0.5	
57	S	Welch Creek at Highway 64	10/23/89	Bluegill	Fillet/5	26.8	1.4*	1.3	0.52	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Brown Bullhead	Fillet/5	796	30.1	26.906	25.949	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Brown Bullhead	Fillet/5	671	77.9	68.436	81.675	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	White Catfish	Fillet/5	198	73.9	72.012	7.544	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	White Catfish	Fillet/5	468	45.5	40.931	39.987	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Bluegill	Fillet/5	164	60.5	53.274	72.862	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Largemouth Bass	Fillet/5	360	33.8	31.504	22.707	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Largemouth Bass	Fillet/5	461	19.2	16.929	7.296	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Herring	Whole/4	194	4.3	2.423	15.052	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Gizzard Shad	Whole/4	291	110	64.427	452.584	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Gizzard Shad	Whole/4	291	108.8(dup)	63.194	453.571	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Gizzard Shad	Whole/4	198	88.6	49.81	380.14	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Chub Sucker	Whole/4	60	52.8	45.968	61.982	
58	S	Welch Creek Old Discharge Trowbridge Rd.	April/May 1989	Golden Shiner	Whole/4	152	45.5	26.903	182.802	
58	S	Welch Creek Old Discharge Trowbridge Rd.	Sept 27,29,1989	Black Crappie	Fillet/5	310	44.7*	34.5	102	
58	S	Welch Creek Old Discharge Trowbridge Rd.	Sept 27,29,1989	Channel Catfish	Fillet/3	1229	123.1*	121	21.3	

S= Industry Monitored, A=Agency ND=non-detected EMPC=Estimated Maximum Potential Concentration

Summary of Individual Dioxin Fish Tissue Samples

Station Number	BY	Location	Date Sampled	Species	Sample Type / #	Average weight g	Dioxin Total TEQ ppt	2378-TCDD ppt	2378-TCDF ppt	% Lipids
59	A	Welch Cr at old Weyerhaeuser discharge	12/14/87	Largemouth Bass	fillet/5	~429	20.3	18.24	20.1	
59	A	Welch Cr at old Weyerhaeuser discharge	12/14/87	Cr Chub	whole/1	640	180.17	157.5	207.38	
59	S	Welch Cr at old Weyerhaeuser discharge	May 23-Sept 21, 1990	Black Crappie	fillet/9	163	7.3*	6.2	11	1.92
59	S	Welch Cr at old Weyerhaeuser discharge	Sept 19-21, 1990	Channel Catfish	fillet/3	2314	11.4*	11	4.2	2.67
59	S	Welch Cr at old Weyerhaeuser discharge	23-May-90	Largemouth Bass	fillet/4	348	5.0*	4.6	3.5	4.36
59	S	Welch Cr at old Weyerhaeuser discharge	May 23-June 5, 1990	Pumpkinseed	fillet/11	86	4.6*	3.8	7.8	4.54
59	S	Welch Cr at old Weyerhaeuser discharge	June 5-Sept 27, 1990	White Catfish	fillet/5	362	6.4*	6.1	2.7	2.18
59	S	Welch Cr at old Weyerhaeuser discharge	June 5-Sept 27, 1990	White Catfish	fillet/5	362	6.5*(dup)	6.2	3.4	2.46
59	S	Welch Cr at old Weyerhaeuser discharge	5-Jun-90	White Catfish	fillet/1	2213	5.5*	5.3	1.8	3.54
59	A	Roanoke River at Plymouth	10/11/90	Blue Crab	meat/18		6.0*	3.1	29	1.85
60	A	Roanoke River near Weyerhaeuser discharge	12/20/88	Largemouth Bass	fillet/5	1387	23.2	17.612	55.96	
60	S	Roanoke River near Weyerhaeuser discharge	April/May 1989	White Catfish	Fillet/8	125	26.2	21.507	36.835	
60	S	Roanoke River near Weyerhaeuser discharge	April/May 1989	Bluegill	Fillet/4	126	18.5	17.881	4.529	
60	S	Roanoke River near Weyerhaeuser discharge	April/May 1989	Bluegill	Fillet/6	57	18.2	17.329	8.204	
60	S	Roanoke River near Weyerhaeuser discharge	April/May 1989	Black Crappie	Fillet/4	54	7	5.482	14.971	
60	S	Roanoke River near Weyerhaeuser discharge	April/May 1989	Yellow Perch	Fillet/4	117	7.6	4.726	28.197	
60	S	Roanoke River near Weyerhaeuser discharge	April/May 1989	Gizzard Shad	Whole/2	273	0.5	ND	0.773	
61	A	Middle River at NC 45	5/2/89	Largemouth Bass	fillet/3	433	9.5	9.1	3.2	
61	A	Middle River at NC 45	5/2/89	Channel Catfish	fillet/3	1620	94.2	77.7	147	
62	A	Albemarle Snd @ Terrapin Pt	5/2/89	Largemouth Bass	fillet/3	924	8.1	7.107	9.687	
63	S	Roanoke River at Marker 15	April/May 1989	White Catfish	Fillet/6	370	14.6	11.981	19.088	
63	S	Roanoke River at Marker 15	April/May 1989	White Catfish	Fillet/6	370	14.1*(dup)	11.394	19.11	
63	S	Roanoke River at Marker 15	April/May 1989	White Catfish	Fillet/4	203	18.9	12.177	29.945	
63	S	Roanoke River at Marker 15	April/May 1989	Bluegill	Fillet/7	42	16.9	14.799	20.531	
63	S	Roanoke River at Marker 15	April/May 1989	Bluegill	Fillet/4	56	8	6.967	9.827	
63	S	Roanoke River at Marker 15	April/May 1989	Black Crappie	Fillet/4	92	21	19.445	14.563	
63	S	Roanoke River at Marker 15	April/May 1989	Black Crappie	Fillet/4	233	27.6	25.135	24.668	
63	S	Roanoke River at Marker 15	April/May 1989	Black Crappie	Fillet/4	233	36.9*(dup)	34.147	27.421	
63	S	Roanoke River at Marker 15	April/May 1989	Yellow Perch	Fillet/3	54	16.3	10.289	59.015	
63	S	Roanoke River at Marker 15	10/2/89	Bluegill	Fillet/7	86.7	20.8*	16.6	42	
63	S	Roanoke River at Marker 15	Sept 27, 29, 1989	Black Crappie	Fillet/4	140	4.8*	3.6	11.8	
63	S	Roanoke River at Marker 15	Sept 27, 29, Oct 4, 1989	Channel Catfish	Fillet/3	538	43.7*	41.2	24.6	
63	S	Roanoke River at Marker 15	Sept 11-13, 1990	Black Crappie	fillet/5	192	1.5*	0.81	6.5	2.55
63	S	Roanoke River at Marker 15	Sept 11-13, 1990	Channel Catfish	fillet/5	1409	26.4*	26	3.8	2.56
63	S	Roanoke River at Marker 15	Sept 11-12, 1990	Largemouth Bass	fillet/8	361	2.4*	1.7	6.9	2.16
63	S	Roanoke River at Marker 15	Sept 11-12, 1990	Largemouth Bass	fillet/8	361	1.9*(dup)	1.5	4	
63	S	Roanoke River at Marker 15	Sept 11-13, 1990	White Catfish	fillet/5	396	8.0*	8	ND(0.14)	2.66
64	A	Roanoke River at Sans Souci	5/2/89	Largemouth Bass	fillet/1	675	10.8	10.328	4.192	
64	A	Roanoke River at Sans Souci	5/2/89	Largemouth Bass	fillet/1	560	21.8	21.4	3.8	
64	A	Roanoke River at Sans Souci	5/2/89	Redear	fillet/2	450	6.7	6.3	6.6	
64	A	Roanoke River at Sans Souci	12/20/88	Largemouth Bass	fillet/5	530	29	27.112	19.299	
64	A	Roanoke River at Sans Souci	5/2/89	Largemouth Bass	fillet/5	452	13.6	13.29	2.538	
64	A	Roanoke River at Sans Souci	5/2/89	Largemouth Bass	fillet/5	342	24	23.8	2.3	
65	A	Roanoke River at Mouth	5/2/89	Largemouth Bass	fillet/1	1008	9.1	8.709	3.171	
65	A	Roanoke River at Mouth	5/2/89	White Bass	fillet/1	575	0.9	EMPC(1.3)	8.2	
65	A	Roanoke River at Mouth	5/2/89	Largemouth Bass	fillet/1	850	10.7	9.4	12	
65	A	Roanoke River at Mouth	5/2/89	Largemouth Bass	fillet/4	558	11.3	11.25	3.576	
65	A	Roanoke River at Mouth	5/2/89	Largemouth Bass	fillet/6	420	12.0	11.7	2.7	
66	S	Cashie River at Windsor	Sept 19-20, 1990	Black Crappie	fillet/2	310	0*	ND(0.16)	ND(0.25)	3.43
66	S	Cashie River at Windsor	Oct 6-7, 1990	Channel Catfish	fillet/9	2592	1.6*	1.6	ND(0.26)	3.42
66	S	Cashie River at Windsor	Sept 20-Oct 7, 1990	Largemouth Bass	fillet/9	726.5	0*	ND(0.04)	0.08	4.43
66	S	Cashie River at Windsor	Sept 19-Oct 7, 1990	Yellow Bullhead	fillet/6	493	0*	ND(0.05)	ND(0.25)	2.53
67	S	Cashie River at San Souci Ferry	19-Sep-90	Channel Catfish	fillet/1	5033	0*	ND(0.32)	ND(0.74)	3.86
67	S	Cashie River at San Souci Ferry	Sept 19-20, 1990	Channel Catfish	fillet/10	2004	1.4*	1.4	ND(0.45)	5.05
67	S	Cashie River at San Souci Ferry	18-Sep-90	Largemouth Bass	fillet/11	366	0*	ND(0.41)	ND(0.59)	2.66
67	S	Cashie River at San Souci Ferry	Sept 19-20, 1990	Largemouth Bass	fillet/3	1759	0*	ND(0.23)	ND(0.37)	1.6
68	S	Albemarle Sound at Marker 1	Sept 11-13, 1990	Channel Catfish	fillet/10	1656	16.7*	16	7.2	3.39
68	S	Albemarle Sound at Marker 1	Sept 11-13, 1990	Channel Catfish	fillet/10	1656	21.5*(dup)	21.1	4.3	
68	S	Albemarle Sound at Marker 1	Sept 11-13, 1990	Channel Catfish	fillet/7	1529	10.1*	9.7	3.8	3.1
68	S	Albemarle Sound at Marker 1	Sept 11-13, 1990	Largemouth Bass	fillet/3	367	1.8*	1.2	6.4	3.49
68	S	Albemarle Sound at Marker 1	Sept 12-21, 1990	White Perch	fillet/12	64	7.8*	5.1	28	2.81
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	Sept/Oct 1989	Largemouth Bass	Fillet		0*	ND(0.9)	0.21	
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	Aug/Sept 1989	Bluegill	Fillet		0*	ND(0.7)	0.29	
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	Aug 18-25 1989	Channel Catfish	Fillet		2.3*	2.3	ND(0.18)	
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	March 8-13, 1990	Largemouth Bass	Fillet		0*	ND(0.5)	ND(0.3)	
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	March 8-13, 1990	Bluegill	Fillet		0*	ND(0.19)	ND(0.11)	
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	2/13/90	Channel Catfish	Fillet		4.0*	3.9	1.33	
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	2/13/90	Channel Catfish	Whole		0.8*	0.8	0.23	
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	3/13/90	Blueback Herring	Drawn		1.4*	1.2	1.5	9.26
69	S	Blackwater R. app 15 mi UPS Union Camp discharge	3/13/90	Blueback Herring	Whole		1.9*	1.8	1	6.56
70	S	Blackwater R. app 5 mi UPS Union Camp discharge	Feb-88	Bullhead	Fillet		1.2*	1.2	0.42	
70	S	Blackwater R. app 5 mi UPS Union Camp discharge	Feb-88	Catfish	Fillet		1.8*	1.8	ND(0.53)	
70	S	Blackwater R. app 5 mi UPS Union Camp discharge	Feb-88	Catfish	Fillet		2.1*(dup)	2.1	ND(0.29)	
70	S	Blackwater R. app 5 mi UPS Union Camp discharge	May 2-12, 1989	Channel Catfish	Fillet/3		1.3*	1.3	0.41	
70	S	Blackwater R. app 5 mi UPS Union Camp discharge	May 2-12, 1989	Channel Catfish	Fillet/3		1.5*(dup)	1.5	0.35	
70	S	Blackwater R. app 5 mi UPS Union Camp discharge	May 2-12, 1989	Channel Catfish	Whole/Comp		1.4*	1.4	0.39	
70	S	Blackwater R. app 5 mi UPS Union Camp discharge	May 2-12, 1989	Channel Catfish	Whole/Comp		1.6*	1.6	0.46	

S= Industry Monitored, A=Agency ND=non-detected EMPC=Estimated Maximum Potential Concentration

Summary of Individual Dioxin Fish Tissue Samples

Station Number	BY	Location	Date Sampled	Species	Sample Type / #	Average weight g	Dioxin Total TEQ ppt	2378-TCDD ppt	2378-TCDF ppt	% Lipids
71	S	Blackwater R. at Union Camp discharge	10/6/88	Bullhead	Fillet		1.9*	1.84	0.68	
71	A	Blackwater R. at Union Camp discharge	9/20/88	Largemouth Bass	Fillet		1.5*	1.45		
72	S	Blackwater Mill Site	4/15/90	Blueback Herring	Drawn		1.2*	0.99	2.2	3.94
72	S	Blackwater Mill Site	4/15/90	Blueback Herring	Whole		1.3*	1.1	2	6.72
73	S	Nottoway River Below Rt 671	Nov 10-29, 1989	Channel Catfish	Fillet		2.2*	2.2	0.21	
73	S	Nottoway River Below Rt 671	Nov 10-29, 1989	Channel Catfish	Whole		0.8*	0.84	ND(0.2)	
73	S	Nottoway River Below Rt 671	2/2/90	Channel Catfish	Fillet		0.6*	0.56	ND(0.7)	
73	S	Nottoway River Below Rt 671	2/7/90	Channel Catfish	Whole		0.3*	0.33	ND(0.1)	
74	A	Chowan River at Riddicksville	1/18/89	Largemouth Bass	fillet/5	360	ND	ND	ND	
74	A	Chowan River at Riddicksville	1/19/89	Redhorse Sucker	whole/5	494	0.636	ND	6.359	
75	S	Meherrin River Rt 258 just below Murfreesboro	12/8/89	Channel Catfish	Fillet		2.7*	2.7	ND(0.30)	
75	S	Meherrin River Rt 258 just below Murfreesboro	12/8/89	Channel Catfish	Whole		1.1*	1.1	0.24	
75	S	Meherrin River Rt 258 just below Murfreesboro	2/2/90	Channel Catfish	Fillet		0.7*	0.68	ND(0.11)	
75	S	Meherrin River Rt 258 just below Murfreesboro	2/2/90	Channel Catfish	Whole		4.1*	4.1	ND(0.11)	
76	S	Chowan River at Winton	Feb-88	Catfish	Fillet		4.5*	4.5	ND(0.39)	
76	S	Chowan River at Winton	Feb-88	Catfish	Fillet		5.6*(dup)	5.6	ND(0.86)	
76	S	Chowan River at Winton	3/18/89	Channel Catfish	Fillet/3		32*	32	0.34	
76	S	Chowan River at Winton	3/18/89	Channel Catfish	Fillet/3		21.1*(dup)	21	0.5	
76	S	Chowan River at Winton	3/18/89	Channel Catfish	Fillet/3		28*(dup)	28	0.44	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Fillet/3		36.3*	36	3.2	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Fillet/3		29.3*(dup)	29	2.6	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Fillet/3		31.3*(dup)	31	3.2	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Fillet/3		30.9*(dup)	30.6	2.9	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Whole/Large		13.7*	13	6.8	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Whole/Small		5.9*	5.8	1.1	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Whole/Small		7.2*	7.1	1.2	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Whole/Small		4.9*	4.8	0.89	
76	S	Chowan River at Winton	May 20-June 4, 1989	Channel Catfish	Whole/Large		12.6*	12	6.2	
76	S	Chowan River at Winton	Oct 5-27, 1989	Channel Catfish	Fillet		12	12	0.32	
76	S	Chowan River at Winton	10/5/89	Largemouth Bass	Fillet		0.2*	0.24	0.15	
76	S	Chowan River at Winton	10/6/89	Bluegill	Fillet		0*	ND(1.0)	0.2	
76	S	Chowan River at Winton	10/5/89	Brown Bullhead	Fillet		0.8*	0.81	0.22	5.35
76	S	Chowan River at Winton	11/21/89	Bluegill	Fillet/7	29	0.8*	0.74	0.38	
76	S	Chowan River at Winton	11/21/89	Pumpkinseed	Fillet/5	42.8	0.5*	0.48	0.35	
76	S	Chowan River at Winton	2/28/90	Largemouth Bass	Fillet		0.7*	0.66	0.27	
76	S	Chowan River at Winton	Feb 22-23, 1990	Channel Catfish	Fillet		49.8*	49.7	0.8	
76	S	Chowan River at Winton	Feb 22-23, 1990	Channel Catfish	Whole		73.2*	73	1.8	
76	S	Chowan River at Winton	3/5/90	Bluegill	Fillet		0*	ND(0.9)	ND(0.5)	
76	S	Chowan River at Winton	4/11/90	Blueback Herring	Drawn		1.4*	1.1	3.2	6.54
76	S	Chowan River at Winton	4/11/90	Blueback Herring	Whole		1.3*	1	3.2	7.09
76	A	Chowan River at Winton	9/6/90	Largemouth Bass	fillet/13	877	0.4*	EMPC(0.40)	0.2	0.3
76	A	Chowan River at Winton	9/6/90	White Catfish	fillet/7	138	1.2*	EMPC(1.2)	0.45	0.42
77	S	Chowan River Near Marker 16	11/30/89	Channel Catfish	Fillet		21.8	21.4	3.5	1.3
77	S	Chowan River Near Marker 16	11/30/89	Channel Catfish	Whole		37.9*	37.7	1.6	
77	S	Chowan River Near Marker 16	2/13/90	Channel Catfish	Fillet		24.2*	24	1.9	
77	S	Chowan River Near Marker 16	2/13/90	Channel Catfish	Whole		22.3*	22	3.2	
77	S	Chowan River Near Marker 16	4/18/90	Blueback Herring	Drawn		1.5*	1.2	2.6	5.23
77	S	Chowan River Near Marker 16	4/18/90	Blueback Herring	Whole		1.2*	0.92	3	5.95
78	S	Chowan River Near Marker 9	12/5/89	Channel Catfish	Fillet		28.2*	27.7	4.6	
78	S	Chowan River Near Marker 9	12/5/89	Channel Catfish	Whole		70.2*	69.7	5.0	
78	S	Chowan River Near Marker 9	2/13/90	Channel Catfish	Fillet		11.3*	11	3.0	
78	S	Chowan River Near Marker 9	2/13/90	Channel Catfish	Whole		5.2*	4.9	3.4	
79	A	Chowan River at Colerain	9/12/90	Mullet	fillet/3	750	7.6*	4.1	34.6	9.58
79	A	Chowan River at Colerain	9/11/90	Channel Catfish	fillet/10	1113	9.3*	9.1	1.6	5.08
79	A	Chowan River at Colerain	9/11/90	Striped Bass	fillet/6	734	2.5*	1.9	6.3	2.92
79	A	Chowan River at Colerain	9/11/90	White Perch	fillet/10	235	2.0*	1.5	4.6	1.92
80	S	Chowan River Near Marker 5	12/5/89	Channel Catfish	Fillet		37.0*	36.6	3.6	
80	S	Chowan River Near Marker 5	12/5/89	Channel Catfish	Whole		39.1*	39.0	0.85	
80	S	Chowan River Near Marker 5	2/14/90	Channel Catfish	Fillet		24.3*	24.0	3	
80	S	Chowan River Near Marker 5	2/14/90	Channel Catfish	Whole		12.1*	11.7	3.7	
81	A	Chowan River Near Hwy 17 Bridge	9/11/90	White Perch	fillet/10	285	9.3*	7.6	16.8	3.92
81	A	Chowan River Near Hwy 17 Bridge	9/11/90	White Perch	fillet/10	275	3.8*	3	8.1	2.34
81	A	Chowan River Near Hwy 17 Bridge	9/11/90	Striped Bass	fillet/10	729	2.8*	2.1	6.6	2.24
81	A	Chowan River Near Hwy 17 Bridge	9/11/90	Channel Catfish	fillet/9	792	4.7*	4.6	1.2	2.79
81	S	Chowan River Near Hwy 17 Bridge	12/5/89	Channel Catfish	Fillet		57.8*	57.5	2.6	
81	S	Chowan River Near Hwy 17 Bridge	12/5/89	Channel Catfish	Whole		53.1*	52.7	4.2	
81	S	Chowan River Near Hwy 17 Bridge	2/13/90	Channel Catfish	Fillet		24.6*	24	5.6	
81	S	Chowan River Near Hwy 17 Bridge	2/13/90	Channel Catfish	Whole		59.8*	59	8.4	
81	S	Chowan River Near Hwy 17 Bridge	11/14/89	White Perch	Fillet/2	23.5	3.4*	2.8	5.9	
81	S	Chowan River Near Hwy 17 Bridge	11/14/89	Pumpkinseed	Fillet/3	35.3	2.1*	1.8	2.7	
81	S	Chowan River Near Hwy 17 Bridge	6-Oct-90	Channel Catfish	fillet/4	1886	4.9*	4.9*	ND(0.60)	3.75
81	S	Chowan River Near Hwy 17 Bridge	Sept 26-27, 1990	White Catfish	fillet/5	285	0.4*	ND(0.25)	3.6	3.04
81	S	Chowan River Near Hwy 17 Bridge	Sept 26-27, 1990	White Catfish	fillet/5	285	0.2*(dup)	ND(0.17)	1.7	3.66
81	S	Chowan River Near Hwy 17 Bridge	Sept 26-27, 1990	White Perch	fillet/15	119	2.5*	1.8	7.2	4.72
81	S	Chowan River Near Hwy 17 Bridge	Sept 26-27, 1990	White Perch	fillet/14	69	3.8*	2.4	14	4.94
82	A	Albemarle Snd @ Norfolk & Southern	6/8/89	Redhorse Sucker	whole/3	738	50.5	29.6	209	
82	A	Albemarle Snd @ Norfolk & Southern	9/6/90	Mullet	fillet/7	731	8.5*	4.8	37.2	11.88

S= Industry Monitored, A=Agency ND=non-detected EMPC=Estimated Maximum Potential Concentration

Summary of Individual Dioxin Fish Tissue Samples

Station Number	BY	Location	Date Sampled	Species	Sample Type / #	Average weight g	Dioxin Total TEQ ppt	2378-TCDD ppt	2378-TCDF ppt	% Lipids
82	A	Albemarle Snd @ Norfolk & Southern	9/6/90	White Perch	fillet/12	258	5.2*	3.9	12.9	2.47
82	A	Albemarle Snd @ Norfolk & Southern	9/6/90	Atl Sturgeon	fillet/10	448	2.4*	1.3	10.6	0.63
82	A	Albemarle Snd @ Norfolk & Southern	9/6/90	Atl Sturgeon	fillet/10	448	2.2*(dup)	1.2	9.9	0.65
82	A	Albemarle Snd @ Norfolk & Southern	9/6/90	Blue Crab	meat/10		3.4*	2.1	12.6	0.56
82	A	Albemarle Snd @ Norfolk & Southern	9/6/90	Channel Catfish	fillet/10	912	12.3*	11.6	7	7.06
82	A	Albemarle Snd @ Norfolk & Southern	9/6/90	Striped Bass	fillet/10	691	7.4*	5.3	20.5	3
83	S	Albemarle Sound at Hwy 32	Oct 25-Nov 5, 1990	Channel Catfish	fillet/9	1311	0*	ND(1.0)	ND(0.78)	2.89
83	S	Albemarle Sound at Hwy 32	25-Oct-90	Striped Bass	fillet/10	601	7.8*	5.6	22	4.45
83	S	Albemarle Sound at Hwy 32	25-Oct-90	Striped Bass	fillet/10	485	8.7*	6.2	25	7.65
83	S	Albemarle Sound at Hwy 32	Oct 25-Nov 5, 1990	White Catfish	fillet/14	400	0*	ND(0.39)	ND(0.22)	2.8
83	S	Albemarle Sound at Hwy 32	Oct 25-Nov 5, 1990	White Catfish	fillet/14	400	0*(dup)	ND(0.21)	ND(0.04)	3.4
84	A	Albemarle Snd @ Harvey's Point	6/9/89	Striped Bass	fillet/3	883	8.7	6.3	20.3	
84	A	Albemarle Snd @ Harvey's Point	9/10/90	White Cat	fillet/10	316	1.8*	1.8	1	1.17
84	A	Albemarle Snd @ Harvey's Point	9/10/90	Flounder	fillet/10	407	0.6*	EMPC(0.49)	1.2	0.41
84	A	Albemarle Snd @ Harvey's Point	9/10/90	White Perch	fillet/7	236	2.4*	1.8	5.6	1.9
85	A	Albemarle Snd @ Bull Bay	9/6/90	Striped Bass	fillet/17	1021	5.7*	4.4	13.4	1.71
85	A	Albemarle Snd @ Bull Bay	9/6/90	Channel Catfish	fillet/14	1457	14.6*	14.2	3.6	4.71
85	A	Albemarle Snd @ Bull Bay	9/6/90	Croaker	fillet/3	455	0.3*	ND	3	10.64
86	A	Albemarle Sound at Alligator River	9/10/90	Flounder	fillet/15	395	0.8*	0.48	3.1	1.68
86	S	Albemarle Sound at Alligator River	25-Oct-90	Striped Bass	fillet/10	1246	0.3*	ND(0.69)	3.2	3.81
86	S	Albemarle Sound at Alligator River	25-Oct-90	Striped Bass	fillet/10	818	0.8*	ND(0.86)	8.4	4.65
86	S	Albemarle Sound at Alligator River	Oct 6-8, 1990	White Catfish	fillet/10	1022	0*	ND(1.0)	ND(0.99)	3.11
86	S	Albemarle Sound at Alligator River	Oct 6-8, 1990	White Catfish	fillet/10	1022	0*(dup)	ND(0.62)	ND(0.21)	3.99
86	S	Albemarle Sound at Alligator River	Oct 6-8, 1990	White Catfish	fillet/10	579	0*	ND(0.48)	ND(0.19)	2.96
87	A	Albemarle Snd @ Wade Point	6/9/89	White Cat	fillet/5	841	11.5	7.2	28.9	
87	A	Albemarle Snd @ Wade Point	9/11/90	Flounder	fillet/10	459	0.2*	ND	2	1.18
87	A	Albemarle Snd @ Wade Point	9/11/90	Striped Bass	fillet/17	619	4.3*	3.5	7.8	1.8
87	A	Albemarle Snd @ Wade Point	9/11/90	Striped Bass	fillet/17	302	2.3*	1.8	5	1.62
87	A	Albemarle Snd @ Wade Point	9/11/90	Spot	fillet/6	111	2.9*	1.5	13.5	6.36
88	S	Albemarle Sound near Manteo	27-Sep-90	Atlantic Croaker	fillet/10	603	0.1*	ND(0.05)	1.3	5.16
88	S	Albemarle Sound near Manteo	27-Sep-90	Flounder	fillet/10	621	0*	ND(1.0)	ND(1.3)	3.16
89	A	Currituck Sound at Tull's Bay	9/7/90	Largemouth Bass	fillet/9	549	0*	ND	ND	0.3
89	A	Currituck Sound at Tull's Bay	9/7/90	Bluegill	fillet/10	132	0*	ND	ND	0.92
89	A	Currituck Sound at Tull's Bay	9/7/90	White Perch	fillet/10	252	0*	ND	EMPC(0.11)	0.76
89	A	Currituck Sound at Tull's Bay	9/7/90	White Perch	fillet/10	252	0*(dup)	ND	EMPC(0.23)	1.25
89	A	Currituck Sound at Tull's Bay	9/7/90	White Catfish	fillet/8	388	0*	ND	ND	0.52
89	A	Currituck Sound at Tull's Bay	9/7/90	Carp	fillet/6	1727	0.5*	EMPC(0.32)	1.3	4.95
90	A	Pamlico River at Washington	9/5/90	Flounder	fillet/8	342	0*	ND	0.2	0.52
90	A	Pamlico River at Washington	9/5/90	Mullet	fillet/10	520	0.5*	EMPC(0.34)	1.6	6.46
90	A	Pamlico River at Washington	9/5/90	Black Crappie	fillet/3	442	0.1*	ND	0.57	1.7
90	A	Pamlico River at Washington	9/5/90	White Perch	fillet/3	241	0.1*	ND	0.51	1.92
91	A	Pamlico River near South Creek	10/12/89	Blue Crab	HepaPancreas		3.19	0.67	7.42	20
92	A	Pamlico River at Mouse Harbor	9/11/90	Spot	fillet/10	144	0.4*	EMPC(0.28)	0.8	12.87
92	A	Pamlico River at Mouse Harbor	9/11/90	Croaker	fillet/10	220	0*	ND	EMPC(0.07)	9.47
92	A	Pamlico River at Mouse Harbor	9/11/90	Flounder	fillet/10	380	0*	ND	ND	0.45
92	A	Pamlico River at Mouse Harbor	9/11/90	Flounder	fillet/10	380	0*(dup)	ND	ND	0.1
92	A	Pamlico River at Mouse Harbor	9/11/90	Mullet	fillet/10	289	0*	ND	EMPC(0.40)	10.87
93	A	Long Shoal River	9/6/90	Flounder	fillet/10	473	0*	ND	0.2	0.16
93	A	Long Shoal River	9/6/90	Red Drum	fillet/12	505	0*	ND	0.34	1.34
93	A	Long Shoal River	9/6/90	Croaker	fillet/11	238	0.1*	ND	0.6	6.42
93	A	Long Shoal River	9/6/90	Mullet	fillet/6	413	0.9*	EMPC(0.56)	3.6	8.47
94	A	Pamlico Sound at Hatteras Island nr Frisco, NC	11/14/84	Oysters	meat		ND	ND		

Appendix B

**Station Location Summary for Dioxin Samples
Comparing 1990 Collections with Previous Years.**

Station Location Summary for Dioxin Fish Fillet Samples Comparing 1990 Collections with Previous Years

Station	1990	1990	1990	1990	1990	Prior	Prior	Prior	Prior	Prior	All	All	All	All	All
Location	Avg	Num	Num	Num	% obs	Avg	Num	Num	Num	% obs	Avg	Num	Num	Num	% obs
Number	TEQ	Ind	Obs	Species	≥ 3 TEQ	TEQ	Ind	Obs	Species	≥ 3 TEQ	TEQ	Ind	Obs	Species	≥ 3 TEQ
Mecklenburg															
1 Nantahala River at Macon Co	-	-	-	-	-	0	2	1	1	0	0	2	1	1	0
2 Cataloochee Cr.	-	-	-	-	-	2.4	13	1	1	0	2.4	13	1	1	0
3 French Broad River near SR 1129	1.6	27	4	3	25	-	-	-	-	-	1.6	27	4	3	25
4 FBR River at Patton Bridge (Southeast Otis)	1.3	29	5	4	0	19.8	19	6	4	50	11.4	48	11	5	27.3
5 French Broad River near Crab Creek Road	3.3	33	5	5	20	2.0	35	5	5	40	2.7	68	10	6	30
6 French Broad River near Hwy 191	1.8	26	5	5	40	-	-	-	-	-	1.8	26	5	5	40
7 French Broad River near BR Parkway Bridge	0.4	37	5	3	0	-	-	-	-	-	0.4	37	5	3	0
8 FBR at Marshall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9 Lake Hickory	-	-	-	-	-	0.0	4	2	2	0	0.0	4	2	2	0
10 Pigeon River mile 64.5 above Canton, N.C.	-	-	-	-	-	0.0	4	3	3	0	0.0	4	3	3	0
11 Pigeon River mile 58 at Clyde, N.C. at SR 1642	-	-	-	-	-	8.7	10	3	3	100	8.7	10	3	3	100
12 Pigeon River mile 41.5 Waterville Reservoir	-	-	-	-	-	10.3	8	3	3	100	10.3	8	3	3	100
13 Pigeon River mile 41.25 Waterville Reservoir	-	-	-	-	-	9.2	14	5	4	100	9.2	14	5	4	100
14 Pigeon River mile 40 Waterville Reservoir	-	-	-	-	-	8.3	8	3	3	100	8.3	8	3	3	100
15 Pigeon River mile 39 Waterville Reservoir	-	-	-	-	-	16.8	7	2	2	100	16.8	7	2	2	100
Piedmont															
16 Pee Dee R. at Hydro	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17 Deep R. below Ramseur Dam	-	-	-	-	-	0.7	5	1	1	0	0.7	5	1	1	0
18 Haw R. at Saxapahaw	-	-	-	-	-	0.3	15	3	1	0	0.3	15	3	1	0
19 Lumber River 2 miles UPS Alpha Cellulose	0.4	6	3	2	0	0.2	2	1	1	0	0.3	8	4	3	0
20 Lumber River 1 mi. dns Alpha Cellulose	-	-	-	-	-	1.8	15	7	5	28.6	1.8	15	7	5	28.6
21 Lumber River at Hwy 72 nr Hattertown	2.6	31	5	4	40	-	-	-	-	-	2.6	31	5	4	40
22 Lumber River 6 miles DNS Alpha Cellulose at SR2123	-	-	-	-	-	0.1	8	3	5	0	0.1	8	3	5	0
23 Lumber River at Hwy 74 nr Boardman	0.6	16	3	3	0	-	-	-	-	-	0.6	16	3	3	0
24 Medicine Pond nr Morrisville	-	-	-	-	-	5.5	4	1	1	100	5.5	4	1	1	100
Coast															
25 Cape Fear River at Elwell's Ferry	0.0	35	5	4	0	-	-	-	-	-	0.0	35	5	4	0
26 Cape Fear River above Lock & Dam #1	-	-	-	-	-	0.0	10	4	3	0	0.2	10	4	3	0
27 CPF River below Lock and Dam #1	0.3	18	3	2	0	-	-	-	-	-	0.3	18	3	2	0
28 CPF River Below Federal EH 0.25-1.25 miles	-	-	-	-	-	1.0	27	6	5	0	1.0	27	6	5	0
29 CPF River near Bryant Mill Creek	0.9	24	5	5	0	-	-	-	-	-	0.9	24	5	5	0
30 CPF River Below Federal EH 4-6 miles	-	-	-	-	-	1.0	14	4	2	0	1.0	14	4	2	0
31 CPF River near Black River Confluence	0.6	38	6	4	0	-	-	-	-	-	0.6	38	6	4	0
32 Black River near Hunts Bluff	-	-	-	-	-	0.0	16	4	4	0	0.0	16	4	4	0
33 CPF River near Indian Creek	0.0	24	5	4	0	-	-	-	-	-	0.0	24	5	4	0
34 CPF River at Wilmington	0.4	11	3	3	0	-	-	-	-	-	0.4	11	3	3	0
35 Sturgeon Creek Downstream 74/76	Whole fish only					-	-	-	-	-	-	-	-	-	-
36 Snows Cut near Wilmington	Oysters only					-	-	-	-	-	-	-	-	-	-
37 Corentines Creek at SR 1606 nr Wilson	Whole fish only					-	-	-	-	-	-	-	-	-	-
38 Neuse River at Kinston	0.0	16	3	3	0	0.8	7	2	1	0	0.3	23	5	4	0
39 Neuse R. at Greene Thoroughfare above Cowpens	-	-	-	-	-	6.8	35	7	4	71.4	6.8	35	7	4	71.4
40 Neuse River near Weyerhaeuser EH	0.2	39	6	5	0	8.8	38	9	5	33.3	2.7	77	15	8	20
41 Swift Creek at Vanceboro	0.7	22	3	3	0	-	-	-	-	-	0.7	22	3	3	0
42 Neuse River at Marker 52	0.2	36	5	3	0	7.4	29	6	4	83.3	4.1	65	11	5	45.45
43 Neuse River at Marker 38	0.3	53	5	4	0	-	-	-	-	-	0.3	53	5	4	0
44 Trent River at Hayward Creek	0.0	60	4	4	0	4.8	5	2	2	100	2.9	65	6	4	66.6
45 Trent River at Pollockville	0.1	19	5	4	0	-	-	-	-	-	0.1	19	5	4	0
46 Neuse River at Fairfield Harbor-Pl. Point	0.6	42	3	2	0	-	-	-	-	-	0.6	42	3	2	0
47 Slooan Creek	0.3	31	4	4	0	-	-	-	-	-	0.3	31	4	4	0
48 Neuse River at Board Creek	0.2	23	4	3	0	-	-	-	-	-	0.2	23	4	3	0
49 Neuse River at Minnesott Beach	0.4	39	4	3	0	-	-	-	-	-	0.4	39	4	3	0
50 South River nr South River	0.3	25	2	2	0	-	-	-	-	-	0.3	25	2	2	0
51 Neuse River at Oriental	0.1	25	2	1	0	-	-	-	-	-	0.1	25	2	1	0
52 Roanoke River at Weldon (Hatch)	-	-	-	-	-	13.0	5	2	1	100	13.0	5	2	1	100
53 Roanoke River at Weldon	0.4	30	4	4	0	0.2	6	1	1	0	0.4	36	5	5	0
54 Roanoke River at Hamilton	0.4	42	5	4	0	-	-	-	-	-	0.4	42	5	4	0
55 Roanoke River at Williamson	0.2	37	4	3	0	14.6	4	2	2	50	5.8	41	6	3	16.6
56 (Roanoke River) Broad Cr. Slough	-	-	-	-	-	8.0	29	7	4	42.9	8.0	29	7	4	42.9
57 Welch Creek at Highway 64	-	-	-	-	-	6.8	25	5	4	40	6.8	25	5	4	40
58 Welch Creek Old Discharge Trowbridge Rd.	-	-	-	-	-	56.5	43	9	6	100	56.5	43	9	6	100
59 Welch Cr. at old Weyerhaeuser discharge	4.7	38	7	5	100	30.3	5	1	1	100	8.4	43	8	5	100
60 Roanoke River near Weyerhaeuser discharge	-	-	-	-	-	18.8	31	6	5	100	18.8	31	6	5	100
61 Middle River at NC 45	-	-	-	-	-	21.9	6	2	2	100	21.9	6	2	2	100
62 Albemarle Snd @ Terrapin Pt	-	-	-	-	-	8.1	3	1	1	100	8.1	3	1	1	100
63 Roanoke River at Marker 15	8.8	31	5	4	40	20.1	56	12	4	100	16.5	87	17	6	82.4
64 Roanoke River at Sans Soud	-	-	-	-	-	17.7	18	6	2	100	17.7	18	6	2	100
65 Roanoke River at Mouth	-	-	-	-	-	8.8	13	5	2	80	8.8	13	5	2	80
66 Cashie River at Windor	0.4	19	4	4	0	-	-	-	-	-	0.4	19	4	4	0
67 Cashie River at Sans Souci Ferry	0.4	25	4	2	0	-	-	-	-	-	0.4	25	4	2	0
68 Albemarle Sound at Marker 1	11.8	42	5	3	80	-	-	-	-	-	11.8	42	5	3	80
69 Blackwater R. app 15 mi UPS Union Camp discharge	1.4	-	4	4	25	0.8	3	3	0	0	1.1	7	4	14.3	0
70 Blackwater R. app 5 mi UPS Union Camp discharge	-	-	-	-	-	1.2	5	3	0	0	1.2	5	3	0	0
71 Blackwater R. at Union Camp discharge	-	-	-	-	-	1.7	2	2	0	0	1.7	2	2	0	0
72 Blackwater Mill Site	1.2	-	1	1	0	-	-	-	-	-	1.2	-	1	1	0
73 Nottoway River Below Rt 671	0.6	-	1	1	0	2.2	-	1	1	0	1.4	-	2	1	0
74 Chowan River at Riddickville	-	-	-	-	-	0.0	5	1	1	0	0.0	5	1	1	0
75 Meherrin River Rt 258 just below Murfreesboro	0.7	-	1	1	0	23.8	-	1	1	100	12.3	-	2	1	50
76 Chowan River at Winston	8.9	6	5	16.6	-	15.3	-	15	5	66	13.8	-	21	>7	52.4
77 Chowan River Near Marker 16	12.9	2	2	50	-	1.4	-	1	1	0	9.0	-	3	2	33.3
78 Chowan River Near Marker 9	11.3	1	1	100	-	46.3	-	1	1	100	19.8	-	2	1	100
79 Chowan River at Colerain	5.4	29	4	4	50	-	-	-	-	-	0.4	29	4	4	50
80 Chowan River Near Marker 5	14.3	1	1	100	-	37.0	-	1	1	100	30.7	-	2	1	100
81 Chowan River Near Hwy 17 Bridge	8.2	9	4	66	-	21.1	-	3	3	66	10.0	-	12	4	66
82 Albemarle Snd @ Norfolk & Southern	6.3	59	6	5	66.6	-	-	-	-	-	6.3	59	6	5	66.6
83 Albemarle Sound at Hwy 32	2.2	57	5	3	40	-	-	-	-	-	3.3	57	5	3	40
84 Albemarle Snd @ Harvey's Point	1.6	27	3	3	0	8.7	3	1	1	100	3.4	30	4	4	25
85 Albemarle Snd @ Bull Bay	8.9	34	3	3	66.6	-	-	-	-	-	6.9	34	3	3	66.6
86 Albemarle Sound at Alligator River	0.4	65	5	3	0	-	-	-	-	-	0.4	65	5	3	0
87 Albemarle Snd @ Wade Point	2.4	50	4	3	25	11.5	5	1	1	100	4.2	55	5	4	40
88 Albemarle Sound near Martico	0.1	20	2	2	0	-	-	-	-	-	0.1	20	2	2	0
89 Currituck Sound at Tull's Bay	0.1	53	6	5	0	-	-	-	-	-	0.1	53	6	5	0
90 Pamlico River at Washington	0.2	24	4	4	0	-	-	-	-	-	0.2	24	4	4	0
91 Pamlico River near South Creek	Blue Crab only					-	-	-	-	-	-	-	-	-	-
92 Pamlico River at Mouse Harbor	0.1	50	5	4	0	-	-	-	-	-	0.1	50	5	4	0
93 Long Shoal River	0.3	39	4	4	0	-	-	-	-	-	0.3	39	4	4	0
94 Pamlico Sound at Hatteras Island nr Frisco, NC	Oysters only					-	-	-	-	-	-	-	-	-	-
95 Core Sound	Blue Crab only					-	-	-	-	-	-	-	-	-	-

1990, Prior to 1990, and Total of all Observations are Depicted

Appendix C

Current Fish Consumption Health Advisories for Dioxin in North Carolina.

Current Fish Consumption Health Advisories for Dioxin in North Carolina

Pigeon River

No fish caught from the Pigeon River between Canton, N.C. and the Tennessee state line. should be consumed.

Welch Creek

Welch Creek -- the entire creek

Fish in Welch Creek may contain dioxins at levels of concern and should not be eaten. Swimming, boating, and other recreational activities present no health risks and are not affected by this advisory.

Roanoke River

Roanoke River -- from to the mouth of the river emptying into Albemarle Sound. (Includes Broad Creek Slough) to the Highway 17 bridge near Williamston, N.C. Fish in the Roanoke River may contain low levels of dioxins. Consumption of fish should be limited to one meal per person per month. Children and pregnant or nursing women should not consume any fish from the Roanoke River until further notice. Swimming, boating, and other recreational activities present no health risks and are not affected by this advisory. Striped bass, herring, and shad (including roe) are not covered by this health advisory. Consumption of these three migratory fish species is not considered to present a health risk.

Chowan River

Chowan River -- the entire length of the river in North Carolina to the mouth emptying into Albemarle Sound. Catfish in the Chowan River may contain low levels of dioxins. Consumption of catfish should be limited to one meal per person every two months. Children and pregnant or nursing women should not consume any catfish from the Chowan River until further notice. All other fish in the Chowan River may be consumed with no limitations as they have not been found to contain significant dioxins. Swimming, boating, and other recreational activities present no health risks and are not covered by this advisory.

Neuse River

Neuse River -- from Fort Barnwell to a line across the river from Johnson Point to McCotter Point (Minnesott Beach).

Fish in this area of the Neuse River may contain low levels of dioxins. Consumption of fish should be limited to two meals per person per month. Children and pregnant or nursing women should not consume any fish from this area of the Neuse River until further notice. Striped bass, herring, and shad (including roe) are not covered by this health advisory. Consumption of these three migratory fish species is not considered to present a health risk.


Note:

These health advisories are only recommendations and do not constitute a regulatory ban on fishing or fish consumption. Advisories will be updated as necessary.

North Carolina Division of Environmental Management
Water Quality Section
March 25, 1991

Memorandum

To: Early Recipients of the Report:
"1990 Update, Fish Tissue Dioxin Levels in North Carolina"

From: Steve Tedder 

Subject: Page Substitution - Error Correction

Please exchange page 5 of the subject report with the attached page 5 if the last sentence of your copy reads as follows:

Utilizing the statistical approach as previously described, these paired observations indicated a statistically significant correlation at a 95% level of confidence.

This sentence is in error and can be corrected by substituting the following statement.

Utilizing the statistical approach as previously described, these paired observations did not indicate a statistically significant correlation between pairs. Note that two of the observations by Weyerhaeuser indicated less than 1 ppt while Triangle Labs indicated values greater than the 3 ppt evaluation level.

We apologize for any inconvenience that this error may have caused.